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Revised City of Cordova coastal Management Program

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1.0 CHAPTER ONE INTRODUCTION

The original 1978 City of Cordova (City) Coastal Management Plan (CMP) was one of the first coastal management programs initiated in Alaska. At the time of approval and adoption, the CMP addressed the issues and needs of the community, and was one of Alaska's more comprehensive coastal management Plans that had been adopted. Since its latest approved revision in 1986, Cordova has increased in area with the 1994 annexation of lands along Orca Inlet and the Eyak Lake watershed. The Eyak Lake Area Meriting Special Attention (AMSA) is now entirely within the municipal boundaries of Cordova and inside the coastal zone boundary. The other portions of annexed lands, however, were not incorporated into CMP. These lands are now subject to the revised CMP.

Cordova continues to use its coastal management plan to address activities that directly affect the community and its coastal resources. Cordova began a process to update its plan in the late 1990s and completed a draft update (not adopted) in 2000. The information on resources, uses, and activities from the 2000 update are contained in this amendment. For example, issues related to recreation and tourism and natural resource conditions and issues became available for incorporation into the 2000 update and have been carried forward for this plan revision.

1.1 PLAN ORGANIZATION

This revised Cordova CMP meets the requirements for a coastal management plan organization per the Alaska Coastal Management Program (ACMP) and contains the following chapters:

Volume I

- 1.0 Introduction and Plan Organization
- 2.0 Cordova Coastal District Boundary
- 3.0 Issues of Local Concern, Goals, and Objectives
- 4.0 Resource Inventory and Analysis
- 5.0 Enforceable Policies
- 6.0 Eyak Lake Area Meriting Special Attention (AMSA) Boundary and Enforceable Policies
- 7.0 Implementation
- Appendix A Cordova CMP Enforceable Policies
- Appendix B CMP Enforceable Policies Cross Reference Table
- Appendix C Eyak Lake AMSA Enforceable Policies
- Appendix D Definitions
- Appendix E List of Abbreviations and Acronyms
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- Appendix G Eyak Lake AMSA Resource Inventory & Analysis and Issues of Concern, Goals and Objectives

Volume II

Boundary Map

Resource Inventory Maps

AMSA Maps

2.0 CHAPTER TWO

CORDOVA COASTAL DISTRICT BOUNDARY

Cordova's coastal district boundary includes all lands and waters within the municipal boundary. The boundary coincides with the pre-1984 city limits and includes the Eyak Lake AMSA. It includes the entire Eyak Lake watershed.

The coastal district is bounded by southern Prince William Sound to the north and east, and the northeastern Gulf of Alaska on the west and south. Principal river systems within the coastal area include portions of the drainage basins of the Bering River, Martin River, Copper River, Eyak River, and Rude River on the mainland.

3.0 CHAPTER THREE RESOURCE INVENTORY AND ANALYSIS

3.1 INTRODUCTION

A variety of coastal habitats, and fish and wildlife species dependent on those habitats, are supported within the Cordova Coastal District (District). An overview of key coastal resources, their distribution within the district, and timing of important life history events are described in this chapter.

3.2 LOCATION AND SETTING

The City of Cordova is located along the southcentral coastline of Alaska approximately 160 miles southeast of Anchorage, 45 miles south of Valdez, and 25 miles west of the Copper River Delta. Cordova is located along the south side of Orca Inlet where it is relatively protected from direct ocean energy by Hawkins Island to the north, Hinchinbrook Island to the west, and offshore barrier islands on the south side of the Heney Range peninsula.

Mountain ranges to the east, west, and north of Cordova rise from 3,000 to 6,000 feet in elevation. The major land formations in the region are characterized by rugged mountain ranges and a deeply incised coastline formed by glacial activity. Massive valley and piedmont glaciers present throughout the region are the primary source of water supplying river systems, which originate in the coastal area. The coastal area is predominantly a western hemlock/Sitka spruce coastal forest, except for the extensive wetlands of the Copper River Delta. Smaller stands of mountain hemlock and black cottonwood also occur in the coastal area.

3.3 CLIMATE

The climate is described as maritime characterized by cool summers, mild winters, persistently strong surface winds, and heavy year-round precipitation. This type of climate is typical of southeastern areas of Alaska where the proximity of the ocean moderates climatic extremes, causing relatively low seasonal and diurnal temperature variations. The proximity of maritime influence, in addition to the frequent low pressure systems that develop or move out of the Gulf of Alaska, result in heavy precipitation throughout the coastal district. Winds affecting the coastal area are primarily from the east; winds from the southwest are prevalent in April and May, and from the east-southeast in June. On occasion, a “williwaw” (cold wind from the interior mainland) flows over the coastal mountains, funneling down the glaciers.

Generally high levels of precipitation in the region are further exaggerated in the downtown center of the community by the onshore presence of the Chugach Mountains to the east, and the steeply-rising slopes of Mount Eyak and Mount Eccles. Cordova receives more than 160 inches of precipitation annually, and fully half of this precipitation is received as heavy, wet snow. This condition has necessitated one of the most stringent snow load design criteria (100 pounds per square foot) within Alaska.

There are climatic buffers provided by the surrounding mountain ranges that protect the community from direct storm and wind impacts. Average annual wind speed at Cordova is less than 5 miles per hour with easterly conditions being most prevalent, except in April and May when winds shift to east-southeast, and the month of June when prevailing winds are from the southwest. An average of 262 days of the year are cloudy, with the majority of the clear days occurring in the summer months. The average annual temperature variation ranges from 33.6 degrees Fahrenheit (°F) to a maximum of 46.6°F. The last frost of the spring usually occurs in May, and the first frost of the fall generally occurs in mid-September, providing a growing season of approximately 145 days with days above 40°F.

3.4 SOCIOECONOMIC, HISTORIC, AND CULTURAL FEATURES

3.4.1 Population

Cordova has a permanent population of approximately 2,500 residents (Cordova 2005 Draft Comprehensive Plan). However, the fishing industry is very seasonal and results in a summer-time influx of fishermen, cannery laborers, and support industry workers. This transient population inflates the local population to approximately 5,000. In addition, state and federal resource agencies such as the U.S. Forest Service (USFS) and the Alaska Department of Fish and Game (ADF&G), and local research institutes such as the Prince William Sound Science Center and the Copper River Delta Institute bring in significant numbers of seasonal workers, researchers, and students.

According to the 2000 U.S. Census, Cordova's population appears less ethnically diverse and somewhat older than the State as a whole, as presented in Table 3-1.

Table 3-1 Sex and Ethnicity in 2000

City of Cordova Compared to State of Alaska							
City Total	Male	Female	White	Black	AI, E, or A*	A or PI**	Other
2,454	1,336	1,118	1,745	10	254	247	33
	54.4%	45.6%	71.1%	0.4%	10.4%	10.1%	1.3%
State Total							
626,932	324,282	302,650	434,225	21,988	97,012	28,618	45,102
	51.5%	48.3%	69.3%	3.5%	15.5%	4.6%	7.2%

Notes:

*American Indian, Eskimo or Aleut

**Asian or Pacific Islander

% = percent

Source: Alaska Department of Labor

Overall, the state and Cordova population growth is slowing. The City projects population will likely increase at a slow but modest 1 percent growth rate (Cordova 2005 Draft Comprehensive Plan).

3.4.2 Economy

City's economy has historically been linked to the fishing industry. Its strategic location on Orca Inlet in eastern Prince William Sound, west of the Copper River Delta, has made it the center of fishing and fish processing operations for a 38,000 square mile area. Although mining no longer plays a role in the local economy, the construction of the railroad between the Kennecott Copper Mine and Cordova heavily influenced development in the community and provided for the expansion of the commercial fishing industry (Cordova 2005 Draft Comprehensive Plan).

Commercial Fishing and Seafood Processing

The seafood harvesting industry provides about 24 percent of all employment in Cordova. Activities surrounding the two major Prince William Sound fisheries, salmon drift gillnet and salmon purse seine, are largely based in Cordova. In 1999, Cordova residents fished 417 commercial fishing permits while in 2000 the number of permits fished increased to 422 commercial fishing permits (see Table 3-2).

Table 3-2 Catch and Gross Earnings by Fishery, 1999 and 2000

Cordova Residents¹						
Fishery Group	Permits Fished		Total Pounds Harvested		Estimated Gross Earnings	
	1999	2000	1999	2000	1999	2000
Halibut	51	51	694,224	561,944	1,288,774	(X)
Herring Purse Seine	1	1	1,124,751	1,798,342	193,457	169,044
Herring Gillnet	5	5	234,342	409,813	52,258	43,440
Herring Roe/ Pound /Spawn on Kelp	14	6	12,307	0	12,307	0
Lingcod	0	3	0	(X)	0	(X)
Misc. Ground fish	11	19	1,826,047	670,127	414,505	263,226
Sablefish	9	10	147,151	204,864	257,202	479,744
Salmon Drift Gillnet	258	256	9,901,012	12,859,821	14,793,684	9,846,481
Salmon Purse Seine	60	59	42,282,885	42,797,205	6,179,574	7,006,907
Salmon Set net	8	12	(X)	(X)	(X)	(X)

Notes: ¹These figures are for all permits held by Cordova residents regardless of the district they fish in. They do not just represent the Prince William Sound Fishery. For example, some Cordova residents have permits for Bristol Bay and Southeast.

(X) Indicate no data available, or information confidential.

Cordova is dependent on revenues generated by fish processors, permit holders, boat owners, and crewmembers. The City also directly receives municipal funding from Raw Fish Tax payments. Several processors operate cold storage facilities, canneries, custom packing, and value added services – employing over 300 people during the peak of the season. As for economic opportunities, there is likely to be an increasing shift to sport fishing and the further development of custom seafood processors as the visitor and commercial seafood industries grow.

Recreation and Tourism

Cordova's tourism industry is a small but potentially important segment of the local economy. The current Alaska resident and nonresident visitor traffic tends to center around outdoor activities such as fishing, hunting, bird watching, hiking, and wildlife viewing. There is also a significant amount of business-related travel. Cordova draws visitors through special events such as the Ice Worm Festival, the Shore Bird Festival, and the Silver Salmon Derby.

Cordova has experienced a growth in the visitor industry with the establishment of fish charter operations, sightseeing businesses, bed and breakfasts, and other visitor related industries. Public hearings have been held on a number of occasions since 1998 to provide input into the development of the tourism plan, most input was directed towards a desire that Cordova develop plans to manage growth of the visitor industry and to provide for more tourism during the shoulder seasons of fall and winter. The on-going

development within the harbor will continue to provide docking facilities for small cruise ships and increase the safety and usability of the harbor.

Several air taxi operators currently provide flight-seeing trips that include wildlife viewing opportunities. Visitors with a vehicle can see a variety of wildlife along the Copper River Highway and the network of logging roads that are available. Wildlife viewing is also available by boat, where a variety of marine animals such as seals, otters, and whales can be seen.

The Cordova Chamber of Commerce and Visitors Bureau have developed the *Cordova Community Tourism Plan*, and are using this plan to develop attractions aimed at both residents and the visitors (Cordova 2005 Draft Comprehensive Plan). The plan identifies the development of a year-round visitor industry as an opportunity for economic growth within the community. The City Council adopted the Cordova Community Tourism Plan on October 2, 2002. This plan is used by the Chamber of Commerce and the City for the promotion of tourism within the community.

Timber

Although viable in the recent past, the timber industry has declined in Cordova. The Eyak Corporation holds interest in valuable timber resources throughout the area and is ready to begin harvesting as soon as the market turns and logging again becomes a profitable industry. The Eyak Corporation is also interested in the development of value-added products such as log homes, furniture, and specialized dimensional lumber. They have indicated that they are prepared to develop this type of industry as soon as a market can be found and a profit margin realized (Cordova 2005 Draft Comprehensive Plan).

Mining

There is currently no large-scale mineral extraction activity in or near Cordova. However, the Chugach Alaska Corporation holds mineral rights to the lands they own, as well as the lands owned by the Eyak Corporation. While the corporation may not have current plans for mineral extraction, they have indicated they intend to continue exploration activities on these lands. Exploration will be conducted with the intent of locating resources that could be extracted if, and when, the market supports such activity.

Government

Government jobs, including local government, the community hospital, and Cordova School District, account for a large segment of the Cordova economy. In 2000, local government was the largest public sector employer in Cordova. Other important sectors in the Cordova economy include retail trade, service sector businesses, transportation, utilities sector, and the construction industry.

Economic Trends

While salmon fishing forms the base of Cordova's economic livelihood, halibut, herring, sablefish, and ground fish are also an important part of Cordova's waterfront industry. Crab, shrimp, and clams are not a viable seafood industry at this time, but the non-use of these fisheries may cause populations to increase to a point that these species will once again become a viable resource.

Although there has been a decline, the seafood industry is changing and developing into more of a year-round industry. There is a trend toward production of new value-added fish products, which may contribute to expansion of the processing season. A new trend is also emerging in the fish processing industry aimed at fishermen who have their product processed locally, but are marketing these fish to private markets such as seafood sales and restaurants.

The visitor industry, which has historically been a small part of the local economy, has grown in importance. The primary driver for the visitor industry has been small cruise ships, sport fishing, hunting, and recreation. Access to Cordova is difficult for large cruise ships. This restriction means that the pace of development oriented towards the cruise-ship visitor industry has been slow to develop. However, the non-cruise visitor continues to be an attractive market.

3.4.3 Cultural, Archaeological, and Historic Resources

There is a long and diverse history of human use of the lands and waters of Prince William Sound and the Gulf of Alaska. The area is rich in archaeological and historic resources. Prince William Sound, the Copper River Delta, and the Kayak Island area were explored by the Russians, English, and Spanish, starting in the late 1700's; The Russians were the most influential of the early explorers, establishing settlements in Prince William Sound to harvest fur resources. The trading post at Nuchek, on Hinchinbrook Island, was an important Russian settlement. Americans became active in the area in the late 1800's, associated initially with gold and copper exploration, and later for commercial seafood processing. By 1893, commercial fishing areas included the Copper River Delta and Prince William Sound, and canneries were established at several locations near Cordova.

The original natives of the area were the Chugach Eskimos and the Eyak Indians. The Chugach Eskimo, primarily located in the Prince William Sound area, were dependent on sea mammals and salmon for food. The Eyak Indians resided in the Copper River Delta and Cordova areas and used salmon, bear, and mountain goats. Both groups heavily used the coastal areas and the majority of the village sites were located along the shoreline.

The discovery of oil and coal near Katalla brought people to the region, and the discovery of copper at Kennecott resulted in Cordova as the chosen marine terminus for the Copper River and Northwestern Railroad. Commercial fishing developed as the mainstay of the Cordova economy, expanding in cycles through herring, razor clams, halibut, crab, shrimp, and groundfish.

Native Alaskan villages and camps located in the area because of the abundance of fish and game. A fish processing plant was located on the shores of Orca Inlet. However, by 1900, the local Native population and culture was reduced to one village – Cordova. The construction of a major airport near Cordova during World War II has also played a major part in the community's development.

Cordova's economic prosperity continues to be strongly influenced by its strategic location by the productive fishing grounds of Prince William Sound and the Copper River Delta.

3.4.4 Land Use

Cordova's physical setting, dependence on the coastal waters and shoreline, and decisions by individuals, businesses, and governmental agencies, have directly influenced the pattern of land use existing in the community today. Topography is a major limiting factor. Because of the steep and uneven topography, most of the community has developed on the foothills of Mount Eyak to the north, and those of Mount Eccles to the south. Outside of these two areas, the density of development is greatly restricted by physical constraints. As a result, the land use pattern has followed the major road systems like the Copper River Highway and Orca Road, Point Whited Road to the southwest, and along both sides of Eyak Lake to the east.

Commercial

Many residents of Cordova make their living directly from the surrounding waters and almost everyone else is dependent upon the waterfront area for some aspect of their occupation. In most Alaska coastal communities, commercial uses developed adjacent to the waterfront. In Cordova, however, the waterfront was originally occupied by railroad uses, and the business district was forced to locate uphill. The commercial district is still primarily in its original location, on the bluff overlooking the harbor. Older businesses in Cordova are located along First Street and new businesses are expanding along Whitshed Road and the Copper River Highway. The South Fill Development Park is continuing to be attractive for commercial use due to its location adjacent to the boat harbor.

Industrial

The 1964 earthquake has had significant long-term effects in Cordova. It resulted in an uplift of 6.5 to 7.5 feet, causing major changes in the use of waterfront lands. South of the boat harbor, areas that had been accessible by water, became tidal mud flats, and were rendered unusable for waterfront-related industrial purposes. In addition, new or upgraded dock facilities were required for general freight and the canneries. The old facilities could only be reached at high tide.

The earthquake-induced uplift made the development of additional industrial lands possible. Dredged materials from Orca Inlet were used to create the Cordova Industrial Park, immediately north of the boat harbor, and South Fill Development Park, immediately south of the boat harbor. Space for future industrial expansion also has been created with fill material, just north of the Industrial Park (North Containment Dike), and further north, known as the Ocean Dock Subdivision.

The industrial lands located along the waterfront include: Ocean Dock, North Fill Development Park, Cordova Industrial Park, and, the Tidewater Development Park Economic Development District. The City has raw industrial land located further north of the present industrial districts that has not been prepared for development and presently contains a rock pit. There are scattered industrial sites that exist within both residential and commercial districts. The demand for different products and the globalization of the seafood industry have had significant impacts on the shore-based processing and transportation industries. These factors, and others, have increased the rate of change for the industrial base of Cordova.

The City completed the South Fill Development Park in 1985. This area is adjacent to the small boat harbor and contains 17 lots with an average size of 10,000 square feet. The area has been zoned for marine-related retail and wholesale business. The subdivision has several parking lots reserved to provide off-street parking for harbor users. The South Fill Development Park has three commercial buildings including a new 20,000 square-foot Alaska Commercial Store.

The City constructed Municipal Dock, with its associated ferry terminal and fill area, a short distance north of the old facility. This provided a more efficient port facility with space for open storage. A 1985 land use survey counted approximately 140 acres of industrial land and tideland in Cordova. Of this, 127 acres were in general industrial use, mostly concentrated within three distinct areas of the community.

- Chugach Fisheries complex, which occupies approximately 27 acres of land and tideland, is located at the north end of Orca Road,
- The area between the old Alaska Packers plant and Municipal Dock, where about 33 acres are currently taken up by a combination of seafood processors, oil tanks, and dock facilities; and
- The Cordova Industrial Park and adjacent boat harbor area, where close to 35 acres are being used by seafood processors, boat harbor, and dock facilities.

Outside these three main areas, general industrial uses can be found on lands along Lake Avenue, on the west end of Eyak Lake, southeast of town on the Copper River Highway, and southwest of town on Whitshed Road.

The City dump, the sewage treatment plant, and the solid waste baler facility are other industrial uses occurring on Whitshed Road. The Eyak Lake Water Treatment Plant is located on the southwest shore of Eyak Lake. Humpback Creek Hydro-electric Plant is located north of the City near Shepard Point. The Cordova Airport Reserve, out the Copper River Highway, has a number of uses but is predominately industrial in nature. The FAA housing and facilities, U.S. Coast Guard hangar and facilities, Alaska Department of Transportation and Public Facilities (ADOT&PF) maintenance station, the airport terminal building, communication facilities, and a city sludge dump, are located on the reserve.

The industrial districts located along the waterfront offer many advantages for the district. The area is and allows efficient interaction between industrial operations. The area has excellent access to water borne and is located close to equipment supply houses. Utilities are in place and an adequate supply of water and electricity are currently in place. The area is well buffered from the majority of residential uses, but is close enough to provide easy and quick access for the labor force.

Some disadvantages exist due to the demand for industrial lands within the community. There is little room for the construction of new buildings and additions to present structures is very expensive. Due to the scarcity of vacant land near the present industrial buildings, there is little staging area for containerized or van shipping and for the on- and off-loading of these vehicles. Increased automobile use and the need for trucks to access the industrial plants causes periodic traffic problems and congestion. However, these problems are not significant in relationship to the natural and constructed advantages of the area.

According to the City's Draft 2005 Comprehensive Plan, there will continue to be an increase in demand for industrial space in the future. Development of Shepard Point, as a new deep-water port facility, will support the increase demand for industrial properties in Cordova. It is located about six miles north of the road end at the Orca Cannery.

Transportation Facilities and Services

Airport

The Cordova "Mud Hole" Smith Airport, located at 13 Mile Copper River Highway, is the only jet-service airport on the eastern side of Prince William Sound. The airport is state owned and managed by the ADOT&PF. Development on the airport lands must be compatible with the operations of the airport facility. In general, industrial uses are allowed on state owned airport property.

While the jet-serviced airport has been and will remain as an important transportation link for the movement of people, it is increasingly taking on an expanded role in the movement of general freight. There are large areas on the airport available for storage, parking, and buildings, provided the facilities meet the height restrictions imposed by the Federal Aviation Administration (FAA). The airport is self-contained except for power that is supplied by the Cordova Electric Cooperative. Residential uses have not established themselves in the area and are buffered from most of the area's activity.

There is a small general aviation airport located on the north shore of Eyak Lake. A number of charter services, a heliport, and a number of private planes are located there. The Eyak Lake Airport has all the necessary utilities.

Roads

Road improvements to Shepard Point Road, and a deepwater port, would improve marine access to Cordova. Other improvement opportunities include improved ferry service, designation of the Copper River Railroad route as a national “Rails-to-Trails” route, and a Copper River bike path.

Port and Harbor Development

Fishing and fish processing are major industries in Cordova. The location requirements of this industry are quite specific. Fishermen need a protected harbor where they can keep their vessels. The processing plants require a waterfront location accessible at all times for tenders and other vessels delivering fish. Convenience to commercial dock facilities also is highly desirable since most fish products are shipped from the community. Many industrial establishments in Cordova are dependent on shipping services for the bulk of their freight requirements. Because of shipping schedules, businesses must maintain fairly large inventories and require relatively large amounts of storage and warehousing space.

Cordova's existing port facilities include three docks for large vessels, two boat ramps, a three- tier dock, a small boat harbor, and a few piers associated with the cannery complexes. The City owns all three docks. The small boat harbor facilities are owned by the state and are operated by the City. The Municipal Dock (Ocean Dock) is located approximately three-quarters of a mile north of the small boat harbor just off Orca Road. Ocean Dock is Cordova's main commercial port facility.

Shepard Point, owned in part by both the Eyak Corporation and the Chugach Corporation, is the potential site for the development of a Deep Water Port and the storage of Oil Spill Response Equipment. This land is also located within the unrestricted zoning district and located at the far northern boundary of the community. This site is scheduled for development in the near future, depending on the results of an ongoing Environmental Impact Statement. The Eyak Corporation has approached the City to discuss proper zoning for this area of potential development.

Residential

Due to a combination of topography and poor drainage, developable residential land is in short supply in Cordova. Most of the area was originally platted in a strict grid pattern, often overlain on irregular and mountainous terrain. The plats did not take into consideration the topography, small streams and drainages, and the ever-present wetlands and muskeg areas. The results are a large grid type system of streets and lots that are only moderately developed and only partially able to be developed if landowners re-plat these subdivisions.

Residential development is concentrated uphill from the business district, on the peninsula north of Odiak Slough, and in the old railroad housing area. The greatest densities of residential development are within a three-block area, north of Council Avenue between First Street and Railroad Avenue. Other primary areas include: Odiak Slough, Eccles Lagoon, Saddle Point, Three-Mile Bay, and near the city boundary at Hartney Bay. There are residences along the Copper River Highway at mileposts 4.5, 5.0 and 6.0. In addition, there is dispersed residential development on the north shore of Eyak Lake along the road to Power Creek.

Typical residential lot sizes range from 4,000 square feet within the downtown area, to large acreage in the outlying areas. As sewer and water is extended into new areas, additional development can be expected. The Eyak Native Corporation owns large tracts of land near Mile 13 at the airport and at the end of Whitshed Road. Heney Creek, off Whitshed Road, is also a potential site for new residential development.

The area adjacent to the Tripod Winter Sports Area has many privately owned residential lots that are mostly undeveloped. The eastern part of the community along the Copper River Highway, and the western part of the community along Whitshed Road are much more rural in character, with lot sizes much larger than in the more urban areas. Several short roads lead off from these two state highways into small subdivisions that contain large residential lots.

3.4.5 Land Ownership and Management

Major land owners in the Cordova area include the state and federal government, the City, University of Alaska, Chugach Alaska Corporation, Eyak Corporation and numerous private individuals.

Federal Lands

The Chugach National Forest (CNF) is the largest federal landowner in the area. The CNF covers a large part of Prince William Sound and adjacent uplands. In the Cordova area the CNF original boundary has been altered by land selections first by the state and then by the Eyak and Chugach Alaska Corporations. Within the City limits, CNF lands are generally restricted to areas of high elevation. The two remaining areas in CNF ownership are to the north and east of Middle Arm in Eyak Lake (Township 15 South, Range 2 West of the CRM) and on the south border of the City in the Heney Range (Township 16 South, Range 3 West) (Cordova CMP 2000 Revision). The CNF is managed by the U.S. Forest Service (USFS) in the Department of Agriculture. The USFS has adopted a forest management plan for the Chugach National Forest. This plan and its amendments guide uses and development in the Forest. The USFS generally allows uses through a permit process, leases and resource sales.

The USFS maintains four cabins east of the City in the Copper River flats. The McKinley Trail and McKinley Lake cabins to the north of the Copper River Highway are land accessible. The Tiedman Slough and Pete Dahl cabins, to the south, are accessed by boat. Offshore of the CNF boundary is the Alaska Maritime National Wildlife Refuge. The refuge is managed by the U.S. Fish and Wildlife Service (USFWS).

State Land

Most of the state land is located in three areas: north and south of the city proper, and at the airport tract. The first two areas are managed by the ADNRS. The airport tract is managed by the ADOT&PF. That portion of state land located south of city proper is located upland of Three Mile Bay, near Nicolet Creek (N 1/2 of Section 5, Township (T) 16 South (S), Range (R) 3 West (W), Copper River Meridian (CRM)). The state also owns land in at Crater Lake and upland of the Orca Cannery (Sections 10, 11, and 14, T15S, R3W, CRM, and USS 302); west of the City limits and north of the Rude River; and several selections on Hinchinbrook and Hawkins Islands, Simpson Bay, Sheep Bay, and Port Gravina. In the Copper River Delta, state-owned land is limited to parcels at Flag Point and the Bering River Road Junction. To the west beyond the Copper River flats, Kayak Island, and Katalla are the only areas of state owned uplands in Prince William Sound.

City-Selected Lands

The City has acquired several tracts of land from the state. The larger parcels were selected as municipal selections through the State Municipal Entitlement Act. The City is eligible to receive up to 235 acres of land from the state. To date the City has received about 183 acres of land. Parcels are located south of Point Whitshed Road and the Copper River Highway in USS 1765 and north of the downtown area in USS 1765, USS 5103, and USMS 1061, along the New England Cannery Road. All of the parcels are undeveloped except for a rock quarry. The City has also received title to most of the tidelands within the

Directors Line in the old City limits, Alaska Tideland Survey (ATS) 220 and ATS 1004. Other City lands include numerous parks and the City Hall site.

Tidelands

The State owns all of the submerged lands in Prince William Sound, and to the three-mile limit in the Gulf of Alaska. These areas are rich in natural resources and have significant development potential.

Uses on State Lands

The Prince William Sound Area Plan (PWSAP), prepared by ADNR, guides overall management of state lands in and around Cordova. The PWSAP generated state land classifications and management guidelines for uses only on state lands. Native corporation lands, federal lands and private lands are not directly affected. The PWSAP covers all state uplands but not tidelands in Prince William Sound.

There are several State Marine Parks near Cordova: Boswell Bay State Marine Park on Hinchinbrook Island; and, Canoe Passage State Marine Park on Hawkins Island. In addition, there are state selected lands along Strawberry Channel and the Gulf of Alaska on the southeast side of the Hinchinbrook Island. These parks are managed by the state Division of Parks within ADNR. The parks are undeveloped at this time. The state also maintains a boat launch on the north side of the Copper River Highway at Flag Point on the Copper River.

The Copper River State Critical Habitat Area (CRSCHA) is managed under an agreement between ADF&G and ADNR, subject to a memorandum of understanding between the USFWS and the State. The CRSCHA encompasses the area from Point Bentnick on Hinchinbrook Island, to offshore Palm Point at Katalla. It also includes the uplands of the Martin River drainage, and along the south side of the Copper River Highway. The primary purpose of this CRSCHA is preservation for the abundant waterfowl that use the Copper River Flats.

The ADOT&PF manages the airport tract. The airport is managed for aviation and aviation-related uses. The property is subdivided into lots that are leased; most leases are competitive but leases to a municipality or government agency are negotiated.

University of Alaska

The Alaska Statehood Act granted the University of Alaska (University) rights to select land throughout the new state. The University has completed its selections in the Cordova area. The primary purpose is to raise revenues for operating the state university system. Revenues come from the sale and lease of the land, or the resources on them. The University owns a parcel of land in Section 32, T15S, R3W, CRM, which has potential for development.

The Mental Health Trust Authority (Trust)

The Trust owns and manages lands throughout the State. The Trust owns about eight acres of land in Cordova. The land is in two lots in Alaska Land Survey 81-28 between Eccles and Heney Creeks in Section 32, T15S, R3W, CRM.

Native Corporation Lands

There are a number of private landowners in the District other than individuals. Native Corporations formed under ANCSA own a large amount of private land in the Cordova area. Eyak Corporation (Eyak) is the local village corporation. Chugach Alaska Corporation (Chugach) is the regional native

corporation. Chugach lands are located outside the City near Nelson Bay. They own all the subsurface resources on native corporation lands.

Eyak owns all the native corporation land located inside the City limits. The main Eyak lands are around Eyak Lake, Hartney Bay, along the Copper River Highway, and north of the highway at the airport. West and north of the City, Eyak lands are along Orca Inlet and Orca Bay.

3.5 NATURAL ENVIRONMENT

3.5.1 Geology and Seismic Features

The District is located within the Prince William Sound geologic sub-region of the Gulf of Alaska Tertiary Province. To the east of the City is the Copper River Delta system, and to the north and west of the community is the fjord system of Prince William Sound. Both of these geologic sub-regions are the result of erosion and deposition processes. The fjords of Prince William Sound were formed from glaciation, and the Copper River Delta is a dynamic example of deltatic sedimentation. Sediments discharged from the Copper River are transported west by the prevailing coastal currents, forming an asymmetrical delta system of accumulated alluvium as outwash plains and beaches west of the river mouth. Principal geologic formations in the region are sedimentary and volcanic materials of the Orca Group, comprised of deformed sandstone, siltstone, and mafic pillow lava. In contrast to the Orca Group geologic formations, intrusive igneous formations from the southern coast of Port Gravina and the base of the glaciers in the Copper River Delta area.

The regional pattern of geologic faults resulted from a process of mountain building that occurred approximately 150 million years ago. The City is located on a fault line within an area of high seismic risk. The Cordova area was uplifted over 6 feet as a result of the 1964 Alaska.

A major portion of the City is underlain by argillite (shale-like) and graywacke (sandstone) bedrock on the steeply sloping foothills of Mount Eyak. Slopes are a major factor affecting development within the community, particularly in the area immediately upslope from the commercial district where grades are often in excess of 15 percent.

3.5.2 Soils and Drainage

Soil development is young, with a high water table and poor drainage in many areas of the District. Soils are generally composed of poorly draining decomposed peat or strongly acidic, well-drained soils. These latter soil types are more predominant on steeper slopes. Regionally, the area experiences high precipitation and poor drainage. Surface runoff is high in areas with steep slopes. Areas with slight slope often exhibit impermeability with the development of wetland habitats and swampy, poorly drained conditions. The bedrock underlying the community is generally impermeable, and the fluvio-glacial moraine deposits often have poor absorption capacity. Groundwater sources are present in fluvio-glacial moraine deposits where permeable materials are present.

3.5.3 Natural Hazards

Natural hazards of concern include seismic activity (earthquakes), tsunamis, coastal flooding, and rockslides/snow slides (avalanche). Southcentral Alaska, located along the “ring of fire” is well known for its seismic activity. The U.S. Department of Defense has identified four zones based on potential severity, frequency and damage of seismic activity. Cordova is located in Zone 4, the highest risk area.

The March 1964 earthquake, and the subsequent tidal wave (tsunami), wrought major changes in the physical landscape of the Cordova area. Little structural damage occurred in town and the only fatality occurred at Point Whited. However, the tectonic uplift which took place in the Cordova area had a much greater impact upon this community than structural damage had upon some other communities in southcentral Alaska. Uplifts of 6.5 to 7.5 feet were recorded on the tide gauges at Cordova. Extensive coastal tracts of mud flats, beaches, and reefs throughout the area that were formerly exposed only at lowest minus tides became permanently exposed. Included in the area exposed were the Cordova dock facilities. Extensive dredging in the area was required to allow commercial fishing to continue. Much of Orca Inlet and the former route between Cordova and the fishing grounds off the Copper River Delta became permanently exposed mud flats.

Tsunamis

A tidal wave generated by sudden tectonic displacement, which occurs during an earthquake, is called a tsunami. Two types of tsunami waves could be generated: 1) a teleseismic tsunami, which is earthquake-generated, or 2) a local or "seiche" tsunami caused by massive rock or earth slides either above or below water. This hazard could occur in the Cordova coastal area.

Coastal Flooding

Coastal flooding occurs in the Cordova area, especially in the low-lying areas. Flooding is driven by three sources: storm-driven ocean waves; local drainage associated with high precipitation events; and tsunami. The frequency of major flooding events in this region has a range of 60 to 100 years.

Rockslides and Avalanches

Rockslides and avalanches can occur in areas of steep topography, particularly where heavy snow accumulation occurs. Areas subject to these natural hazards are often characterized by evidence of past events, including areas of rock and rubble accumulation and "avalanche chutes" where periodic snow slides have removed vegetation or shallow surface soils from steep gullies and ravines.

3.5.4 Development Suitability

Soils

Soils play an important role in development suitability. In Cordova, the soils pose a major development constraint. Much of the land is poorly drained. This factor, combined with the abundant rainfall that occurs, results in a soil condition known as muskeg. Almost all of the land of less than 15 percent slope can be characterized as muskeg. Muskeg soils tend to increase the difficulty and cost of development compared to other land that is well drained with stable soils. Construction on muskeg soil is accomplished by either removing the muskeg and back filling with crushed rock to establish a stable foundation, or by employing an alternative foundation method such as driving pilings. Muskeg areas within the City often vary in depths up to twenty feet. Those lands with better drainage and less muskeg have, for the most part, been developed.

Slope

Steep slopes surrounding the community place limitations on development by increasing the cost of foundation work, utilities, and road construction. Special construction measures often must be employed to develop subdivisions on lands with slopes greater than 15 percent. Although slopes are a factor that may affect development suitability, the soils are usually well drained with less muskeg. Lands east along the Copper River Highway are one of the few areas with relatively flat slopes.

Erosion

Erosion can result from the removal of natural vegetative cover. The removal of the vegetation that stabilizes and protects the banks of streams is a common cause of erosion along watercourses. Vegetated slopes that cover unstable soils can be extremely vulnerable to erosion from relatively minor surface disturbances. The potential for erosion depends upon the proximity of adjacent watercourses, the surface drainage plan for cleared or pad fill areas, and the likelihood that runoff waters from snowmelt or rainfall could be channeled or directed across erodible materials such as silt, sand, or organic waste spoil.

Within the District, terrestrial habitats most sensitive to erosion are riparian zones along streams and shoreline habitats, including some wetlands. Hydraulic erosion of stream banks and fills near wetlands and streams can cause siltation and sedimentation of aquatic habitats for significant distances downstream from the site of disturbance.

Flooding

Coastal flooding represents the primary flooding hazard in the District. Uses and activities located within flood prone areas are often subject to insurance and financing requirements. The City maintains information that shows the 100-year flood boundaries based on the Federal Emergency Management Agency's (FEMA) flood insurance rate map (FIRM) for the City, effective April 2, 1979. Since the FIRM was not developed from on-site studies, it may not accurately reflect actual flood hazard conditions.

3.6 RESOURCES AND HABITATS

The following sections describe the resources and habitats of the District and provide an overview of key resources, their distribution within the region, and the timing of important life history events. This information has been carried forth, with minor updating, from the Cordova CMP 2000 Revision, Resource Inventory and Analysis.

The coastal district contains all of the coastal habitats identified in the ACMP, 11 Alaska Administrative Code (AAC) 112.300 HABITATS. The general occurrence of these coastal habitats within the District is shown on the resource inventory maps (Volume II).

3.6.1 Fish Resources

The fish resources of the District include anadromous and freshwater fish, which inhabit the lakes and streams of the coastal district, and marine fish and shellfish, which occur in nearshore and offshore coastal waters.

Salmon and Other Anadromous Fish

Rivers, lakes, and streams, important for the spawning and rearing of five species of Pacific salmon, are dispersed throughout the northern Gulf of Alaska and in the Cordova area. Pink and sockeye salmon comprise the bulk of the commercial fishing harvests in the region, with coho, chum, and Chinook salmon providing lesser percentages of the salmon harvest.

Within the District, all five species of salmon are present in some life history stage throughout the year. In marine waters, immature chinook and coho salmon are present during the winter, and spawning adults of all species use coastal waters, streams, and rivers from June through November. During summer through fall, pink, chum, coho, sockeye, and Chinook salmon are present in the Copper River Flats area from Mountain Slough to Mirror Slough. Sockeye salmon are the dominant species, while smaller runs of

chinook and coho salmon also occur. Pink and chum salmon runs in the Copper River are relatively insignificant. Anadromous populations of Dolly Varden, steelhead, and cutthroat trout also are present throughout the area (Cordova CMP 2000 Revision).

Pink (Humpy) Salmon

Spawning activity generally begins in early June, peaks in mid-August, and extends until early October in the Prince William Sound Area. Pinks are present in the Copper River Delta in June. Early, middle, and late spawning pink salmon stocks are generally distributed by geographic zones associated with different stream temperatures. Early runs peak between late July and early August in Port Fidalgo, Port Gravina, and Sheep Bay. Middle season runs, which normally peak between early and middle-to-late August, use the larger, cold, clear streams of the mainland. Late run pink salmon generally peak from late August to mid-September, and occupy most of the island streams, mainland lake-fed streams, and mainland streams in which only intertidal zones are accessible to the fish.

Female salmon generally enter the spawning streams after the males, carrying 1,500 to 2,000 eggs that are deposited in the gravel of stream bottoms. The eggs hatch in late February and the young emerge from the gravel in April or May, depending on water temperatures. Pink salmon fry quickly depart freshwater, moving to nearshore estuarine and marine waters through their first summer and moving into deeper offshore waters in September.

With few exceptions, pink salmon return from offshore ocean waters to their natal streams to spawn during their second year. This two-year cycle is invariable and fish running in odd-numbered years are effectively isolated from even-year fish. Long-term averages show a greater abundance of pink salmon in the even-year stocks. In the Prince William Sound area, odd-year and even-year pink salmon stocks have adapted differently to the use of the same spawning streams. Odd-year stocks primarily use upstream spawning sites above the influence of tidal waters (43 to 65 percent of the pink salmon). Even-year stocks tend to select intertidal spawning areas, with only 23-28 percent of the fish using spawning sites upstream from the influence of tidal waters.

Chum (Dog) Salmon

Chum salmon spawning activity generally begins in June and extends until early October. Early run stocks enter mainland streams, which are not lake-fed, in early to mid July. Middle run chum salmon stocks spawn in lake-fed stream systems. Late run stocks spawn almost exclusively in small creeks at the upper ends of Port Fidalgo after mid-August.

Chum salmon spawn near both river and stream outlets (intertidal areas) and upstream areas well inland from the coast. The chum salmon alevins (young fry that emerge from the incubating gravel) hatch in early spring and proceed immediately downstream to the ocean, where they remain in nearshore areas during the summer, moving offshore to deeper ocean waters in September. From May through July, chum salmon alevins appear to concentrate in the upper 200 feet of the marine water column, approaching the surface at night. Chum salmon return to their natal streams to spawn after two to seven years of growth in ocean waters. Mature chum salmon reportedly follow routes that parallel the coastline for great distances during their return to spawning streams.

Sockeye (Red) Salmon

Spawning sockeye use the rivers that are connected to lake systems used by juvenile sockeye salmon during their freshwater rearing stage. Spawning activity occurs in stream gravels well upstream from tidal influence. Following hatching of the incubating eggs in the stream gravel the next spring, sockeye alevins remain in the gravel for three to five weeks before emerging as free-swimming fry. The timing of

emergence from the incubating gravel is water temperature-dependent. Sockeye fry then migrate to lake systems where they initially occupy nearshore habitats before moving into deeper lake waters. Here the fry concentrate in the upper 30 to 60 feet of the water column. Sockeye fry are diurnal, moving deeper during daylight and closer to the surface at night. Rearing juvenile sockeye salmon spend two or three years in freshwater before migrating to the ocean as smolts.

Ocean migration for smolts is influenced by currents, and may range from 2 to 25 miles per day. Sockeye smolts appear to remain in nearshore marine waters for the early part of the summer. With time, the sockeye smolts become distributed over the northeast Pacific Ocean, where they spend one to four years (two-year ocean existence is most common) maturing before returning to their natal streams to spawn. Evidence indicates that sockeye salmon have a well-developed homing capability, returning to the same part of the river system in which they were spawned.

Sockeye salmon are the dominant salmon species in the lower Copper River system from late May through late July, with the peak of spawning activity occurring from early July to late October.

Coho (Silver) Salmon

Coho salmon are harvested commercially in the Cordova area from July through early September, with peak harvests occurring in mid-August. The peak of the coho run in the Copper River Delta is early August to early September, with spawning activity in the Copper River system extending from early September to mid-October. Following spawning in river gravels, coho fry emerge about April of the following year, and typically remain in freshwater to rear for one to two years before outmigrating as smolts to salt water. Coho growth is rapid in ocean waters, and they may migrate offshore 1,000 miles or more. Feeding is intensive in ocean waters during the return to natal spawning streams. Coho salmon are strong swimmers capable of moving upstream against currents up to 3 miles per hour.

Chinook (King) Salmon

In the District, Chinook salmon generally use the larger streams for spawning activity, most notably the Copper River. Chinooks passing by Cordova may travel significant distances upstream to spawn. Following spawning runs which occur from mid-May to late June, emergent chinook fry rear for at least one year in freshwater prior to migrating to salt water. Ocean migration may extend 1,000 miles from the spawning stream during growth of Chinook salmon to maturity. The majority of Chinooks return to natal streams to spawn in the fourth or fifth years, but some return as early as the third or as late as the eighth year.

Dolly Varden Char

Dolly Varden char have both anadromous and freshwater resident populations. However, unlike salmon, Dolly Varden do not die after spawning, and may spawn for many years. Eggs are deposited in freshwater stream gravel; the fry hatch the following spring and rear in freshwater for one to four years before outmigrating to the ocean as smolts. Adult Dolly Varden feed in nearshore marine waters from April through December. In the fall, they may enter natal streams to spawn, or non-natal streams to overwinter in lake systems. Freshwater resident Dolly Varden follow the same life history stages, but they do not use marine ocean waters at any time.

Cutthroat Trout

Cutthroat trout return from their short migratory runs to ocean waters to spawn in freshwater systems between April and November.

Marine Fish

Marine fish and bottomfish occur in the District, and support an increasingly important commercial fishery.

Pacific Herring

Herring spawn from April through May, although the peak of spawning varies greatly from year-to-year, and between geographical areas in Prince William Sound and the northern Gulf of Alaska. Water temperature appears to be an important factor governing the timing of spawning activities for herring, and temperatures of 39°F to 40°F are considered minimum. However, temperature requirements for herring spawning in Prince William Sound may be more dependent on degree-days rather than absolute temperatures. Following spawning, mature herring return to offshore feeding grounds and, in August or September, the herring move further offshore to deep-water overwintering areas. Herring become sexually mature at age two, although most herring do not spawn until ages three or four. Herring are used for food, bait, and as a preferred prey species for seabirds, seals, sea lions, and some species of whales.

Halibut and Groundfish

Halibut, black cod (sablefish), Pacific cod, flatfish species, and rockfish occur in the marine waters of the Cordova area. South of the Copper River barrier islands, halibut are fished commercially in the deeper offshore waters. Juvenile halibut also rear in this area.

Shellfish

Crab, shrimp, and mollusks are marine shellfish found in the region of the District. Dungeness, Tanner crab, as well as red, blue, and brown king crab, occur year-round throughout the Copper River Delta.

Tanner (Snow) Crab

Tanner crabs occur from shallow subtidal areas to depths of 1,550 feet, with most occurring at depths below 330 feet. A mud bottom substrate is the preferred habitat. In early spring, breeding adults move to shallower waters 160 to 420 feet to mate, and spawn from March to September. Breeding occurs throughout the eastern portion of Prince William Sound. The female tanner crab carries her eggs for a one-year period, releasing them in the spring where they are suspended in the water column as larval crab for up to 60 days. After being carried by prevailing currents, they settle to the bottom as juvenile tanner crabs.

Adult tanner crabs move back to deeper ocean waters in the fall. Female tanner crabs tend to congregate in certain areas, whereas male tanner crabs tend to be more solitary in their distribution. Juvenile crabs may be found in shallow, subtidal waters throughout the Gulf of Alaska; male juveniles take from four to six years to reach maturity. Soft shell conditions (periodic molting of the exoskeleton) usually occur in the spring (Cordova CMP 2000 Revision). Tanner crabs historically have been harvested in Port Fidalgo, with more recent fisheries in Orca Bay, Port Gravina, and the southeastern section of Prince William Sound through Hinchinbrook Entrance.

Dungeness Crab

Dungeness crabs occur in bays, estuaries, and coastal waters from intertidal waters to depths of 300 feet. Dungeness crabs prefer sand or sand-mud substrate. Males and females move to shallower coastal waters to mate and spawn in April. The female delays fertilization of the eggs for up to four months later, and then holds the eggs for six more months before they are released into the water column. Development from the pelagic larval stage to a bottom-dwelling juvenile stage probably occurs over a period of 30 to

60 days. Juvenile Dungeness crabs generally occupy intertidal and subtidal waters, and are often associated with algal or eelgrass habitats (Cordova CMP 2000 Revision).

King Crab

Red, brown, and blue king crabs are found from intertidal waters to depths of 1,100 feet (350m). King crabs occur in Prince William Sound on the west side of Montague Island and in scattered locations in fjords along the coastline where mud or sand substrates are present. King crabs are not uniformly distributed, and large aggregations may occur in certain areas. King crab distribution appears to vary with season.

Mature king crabs migrate to nearshore waters less than 250 feet in depth in late winter to early spring to mate and spawn. Kelp-covered rocky areas appear to be preferred spawning habitat. King crab eggs hatch from February to April, and juvenile crabs use shallow intertidal habitats (Cordova CMP 2000 Revision).

Shrimp

Several species of shrimp inhabit coastal waters of the Gulf of Alaska from the intertidal area to depths of 1,485 to 1,500 feet beyond the continental shelf. Shrimp typically concentrate in specific areas such as bays and inlets, and each species of shrimp has different habitat preferences in terms of depth and substrate. Breeding occurs from August to October, with eggs hatching in early spring. Shrimp larvae are distributed in nearshore waters, and juveniles are generally found in waters less than 140 feet deep in the winter, migrating to greater depths in the summer. Shrimp are generally distributed throughout the Copper River commercial fishing district, but they are not present in commercial quantities (Cordova CMP 2000 Revision).

Mussels and Clams

Many species of clams occur in Prince William Sound and the northern coast of the Gulf of Alaska. However, only a few species are sufficiently abundant to be valuable for personal use and commercial harvest. The most important species for human use are the razor clam, butter clam, littleneck clam, and cockle. Clams also provide an important food source for sea otters, waterfowl, and bears.

Although clams are generally abundant, commercial harvests in Prince William Sound have been low in recent years. Smaller harvests in recent years are due to the high costs of harvesting and processing, the potential for presence of paralytic shellfish poisoning toxin, and the presence of bacterial pollutant from sewage (Cordova CMP 2000 Revision)

Butter clams are present from intertidal waters to a depth of 30 feet, usually in protected bays where the substrate is comprised of mixed gravel, sand, and mud. Butter clams are common in the Cordova area.

Razor clams are found on sandy exposed beaches from lower intertidal to depths greater than 165 feet. Major clamming beaches occur in the Cordova area; no commercial harvests of razor clams have occurred in the Prince William Sound area since 1988. Razor clams are abundant on the outer islands of the Copper River Flats. The clams are distributed throughout the sandy and muddy areas on the seaward sides of Egg Island, Copper Sands, Grass Island Bar, Kokinhenik Bar, the unnamed bar off the mouth of the Delta, Strawberry Reef, and Softuk Bar. In this area, razor clams are dug for subsistence and personal use, and commercially for food and crab bait.

Blue mussels occur in the rocky mid- to low-intertidal and shallow subtidal zones of Prince William Sound and the Gulf of Alaska. In protected coastline areas, mussels form wide bands on large rocks or cobble beaches. Mussels are an important source of food for a variety of ducks including harlequins,

scoters, and goldeneyes, as well as shorebirds such as the black oystercatcher, sea otters, river otters, and rockfish.

Other species of marine shellfish and invertebrates that occur in the intertidal and shallow subtidal regions of Prince William Sound and the northern Gulf of Alaska include weathervane scallops, littleneck clams, cockles, snails, limpets, barnacles, sea urchins, seastars, polychaete worms, and amphipods. The distribution of these marine invertebrates is discontinuous and highly dependent on specific site characteristics such as substrate type (Cordova CMP 2000 Revision).

3.6.2 Bird Resources

The marine and estuarine habitats of the Gulf of Alaska are used by more than 147 species of birds, including waterfowl, geese, swans, loons, shorebirds, seabirds, and upland passerine species. Bird populations in the Prince William Sound area are highest in April and May, when migratory populations are at their peak and summer breeding populations are arriving (Cordova CMP 2000 Revision).

The Copper River Delta is the most important migratory stopover for birds in the Gulf of Alaska. Up to several million birds use the area seasonally, and numerous species of seabirds, shorebirds, and waterfowl use the Copper River Flats for staging and resting areas during annual migrations. The spring migration occurs from early April to mid-June. Many of the spring migrant birds congregate near herring spawning areas, Orca Inlet, and the Copper River Delta. The fall migration is more protracted and less intense because some birds' southward migration occurs over a longer period of time (July through October), and some birds overfly the area completely. A local population of tundra swans is present in the Copper River Delta year-round. Many spring migrant birds congregate near herring spawning areas, near Orca Inlet, and in the Copper River Delta.

Waterfowl and Loons

Fifty-two species of waterfowl and loons have been recorded in the coastal areas of the Gulf of Alaska. These include 39 species present in the winter, 29 species that breed and nest along the coast, and 10 species of waterfowl that are uncommon or rare in the region. Despite the abundance of waterfowl and loons that use the area, relatively little information is available concerning specific populations or the use of inland, coastal, or over-water routes during migration.

Large numbers of ducks, geese, and swans are distributed throughout the estuaries of the Copper River Delta during the spring and fall. Some of these birds nest and molt in the area, although the majority of waterfowl breed elsewhere (Cordova CMP 2000 Revision).

Ducks

Breeding populations of ducks in the coastal areas of the Gulf of Alaska are locally abundant, but comprise relatively low numbers in comparison with populations elsewhere in Alaska. In Prince William Sound, mallards, harlequin ducks, Barrow's goldeneyes, and common mergansers have been recorded as breeding in the forested regions of the Sound. In offshore waters of the Gulf of Alaska, summer surveys have revealed the presence of large numbers of non-breeding sea ducks.

Dabbling duck populations in the north-central Gulf consist primarily of northern pintails, mallards, American wigeon, green-winged teal, northern shoveler, and gadwall, with smaller numbers of other dabbling ducks present seasonally. Major concentrations of feeding and migration staging for ducks occurs in estuaries, lagoons, river deltas, tidal flats, and lowland ponds. High-quality feeding habitat in these areas provides an opportunity for migrating waterfowl to restock their energy reserves for breeding

and nesting in the spring, and migration/wintering in the fall. Most dabbling ducks arrive in the District by mid-May and depart by late September or early October.

Pintails are common breeders on the Copper River Delta. Although pintails are abundant during the fall on Copper River Delta marshes, most of the large migrant flocks pass quickly through the region. Locally, pintails may be abundant until mid-October.

Mallards are common residents of the north Gulf of Alaska coast as abundant migrants, fairly common breeders, and common winter visitors. Fall migrant mallards are common from late August to mid-October, and wintering mallards are evident in flocks on tidal flats and beaches of bays, fjords, and inlets along the Gulf coast.

Gadwall are fairly common local residents along the north coast of the Gulf of Alaska, and common spring migrants on the grass flats of the Copper River Delta. Gadwall are uncommon on tidal flats and marshes elsewhere in the region. Migrant gadwalls pass through the District from mid-April to mid-May, usually in association with other dabbling ducks. In the fall, gadwall are common on the Copper River Delta, although they are generally uncommon or rare elsewhere along the north Gulf coast.

The American wigeon is a resident of the north Gulf of Alaska coast and occurs seasonally as an abundant migrant, a common breeder, and a rare winter visitor. Fall migrant wigeons appear on tidal flats of the Copper River Delta in mid-August and are abundant in September. Post breeding wigeons, often in flocks of several hundred birds, are present on the Copper River Delta in mid-September and generally remain until mid-October.

Green-winged teal appear seasonally as abundant migrants, common breeders, and rare winter visitors. Spring migrants are most abundant in late April on the marshes of the Copper River Delta, where they utilize upper grass flats and willow-alder brush flats. Small groups of males regularly visit the outer tidal flats of the Copper River Delta after mid-July, and become fairly common in August. The majority of the migrating green-winged teal move through the tidal flats of the District in late August through early September.

Northern shovelers are a fairly common migrant and locally common breeder along the north coast of the Gulf of Alaska. Spring migrants arrive on the Copper River Delta by the third week of April, and they remain common in the area from early May to early June. Shovelers are among the most abundant nesting dabbling ducks on the Copper River Delta wetlands. Fall migrants appear on the Delta tidal flats in mid-August, where they remain fairly common until early October.

Diving ducks are distributed throughout the District at elevations below 1,200 feet. In the northern Gulf of Alaska, divers are represented by: greater scaup, harlequin duck, oldsquaw, surf scoter, white-winged scoter, black scoter, Barrow's goldeneye, common goldeneye, bufflehead, red-breasted merganser, common merganser, Steller's eider, Pacific common eider, and king eider. Diving ducks prefer larger and deeper inland bodies of water and marine coastal waters within the 60-foot depth contour; protected estuarine habitats are more heavily used than open ocean waters.

Diving ducks that do not winter in the region migrate northward through the Cordova region from mid-April to mid-May. Nesting for species common to the region occurs from early June to late June. Some species such as scoters and oldsquaws leave nesting areas in mid-July to molt at sea, often near estuaries. Scaup, goldeneye, and other divers molt from mid-July to late August on large inland lakes that are traditional molting areas. Fall migration to the south for diving ducks extends from late August until freeze-up.

Greater scaup spring migrants are abundant in the Copper River Delta area from late April to mid-May. In the Cordova region, breeding occurs primarily in the Copper River Delta near the outer marsh ponds from west of Grass Island Slough to the outlet of Eyak Lake. Peak movements of fall migrants pass through the District in late September to early October; wintering birds are common in protected coastal waters near unfrozen tidal flats.

Red-breasted mergansers are an abundant migrant along the Gulf of Alaska coast, an uncommon summer visitor and local breeder, and a common winter resident in the region. Spring migrants appear along the outer coasts during April and May, and are fairly common breeders on the Copper River Delta. Fall migrants become locally abundant along the coast in October and November.

The harlequin duck is an abundant resident of the north Gulf coast. During fall, winter, and spring, harlequins are conspicuous along the rocky shores of bays, fjords, and islands. Harlequins nest by fast-running clear streams and are seldom seen in the freshwater marsh habitats associated with most ducks. Information is limited concerning migration habits of harlequin ducks, but after nesting, they can be found dispersed along the coast where they remain most of the year (Cordova CMP 2000 Revision).

Geese

The tidal salt marshes, alluvial tidelands, and delta of the Copper River provide important spring and fall habitats for geese. Within the District, the dusky Canada goose is the principal breeding subspecies of Canada goose that occur in the Gulf of Alaska. The entire world population of the dusky Canada goose occupies the Copper River Delta seasonally. In the spring and fall, concentrations of dusky Canada geese are present around Egg Island, Martin River Slough, Pete Dahl Slough, and Alaganik Slough. Dusky Canada goose spring migrants are present from late March to late May. A large segment of the Gulf population (estimated at 35,000 birds) breeds on the Copper River Delta, where the habitat supports prime nesting opportunities for densities of up to 108 nests per square mile. Summer nesting sites are located on Castle and Egg islands, and in the area between Government Slough and the Eyak River. Fall migration through the region occurs from September to mid-November. Birds begin leaving the Copper River Delta in late September, and are gone from the area by the end of October.

In addition to Canada geese, other species of geese present in the region during migration include, white-fronted geese, lesser snow geese, emperor geese, and Pacific black brant. White-fronted geese use habitats in the Copper River Delta area. Spring migrants arrive in late April, are locally common during early May, and usually depart the region by the end of May. Large numbers of white-fronted geese gather on the marshes of the eastern part of the Copper River Delta each fall. Lesser snow geese are commonly observed on the Copper River Delta in late April to early May; fall migrants are rarely present before late September (Cordova CMP 2000 Revision).

Swans

Trumpeter swans are locally common residents of the freshwater areas in the northeastern Gulf of Alaska. The first spring migrants usually arrive on the Copper River Delta during the last week of March, and are commonly observed by mid-April. Flocks of trumpeter swans, and mixed flocks of trumpeter and tundra swans, migrate through the District between mid-April and early May. In the Cordova area, nesting is confined largely to the coastal plain of the Copper River Delta. In late summer and early fall, large numbers of trumpeter swans congregate on ponds and marshes along the coast. By mid-October, most trumpeters have migrated south, although a few may remain till November if the weather is mild. A few family groups of trumpeter swans winter on the open freshwater outlets of Eyak Lake and Martin Lake, and in other suitable habitat locally. A summary of historical locations and populations of nesting trumpeter swans in Alaska is available from the U.S. Fish and Wildlife Service (Conant et. al. 1993).

Tundra swans are common migrants, and casual summer and winter visitors along the Gulf of Alaska coast. This species prefers shallow waters where rooted bottom vegetation can be reached easily, although upland grazing on grass, sedges, and forbs is not uncommon. Spring migrants are present in the region from mid-April through mid-May, with the peak of the northward migration occurring during the latter part of April. Fall migration through the Cordova region extends from mid-September until early November, with the period of peak movement occurring in early October. Some tundra swans may overwinter in the region (Cordova CMP 2000 Revision).

Loons

Loons, which occur in or migrate through the District, include the resident red-throated loon and migratory common loon, yellow-billed loon, and Arctic loon. Common loons migrate through the region from mid-April to mid-May. Fall migrants appear along the coast in September, and become more common from early October through early November. Red-throated loons are residents of the north Gulf Coast region. They occur seasonally as common migrants, locally common breeders, and occasionally common winter visitors. Spring migrants pass through the District along the outer coast from mid-April to late May; fall migrants are fairly common in these same coastal areas from early September until early November. Common loons may be fairly common during the winter in sheltered bays and inlets. The yellow-billed loon is primarily a migrant through the District, traveling northward from late March to June and southward from late September through mid-November.

The Arctic loon is present seasonally in marine waters as a common migrant, an uncommon summer visitor, and a common winter visitor. Spring migrants are common from late April through mid-May. Fall migrants through the Cordova region are common along the coast from late September through early November. During the winter (November through May), wintering Arctic loons are common along the coast in bays and fjords. These are the only loons that form large, tight aggregations of birds (Cordova CMP 2000 Revision).

Shorebirds

Of the 42 species of shorebirds commonly occurring in the Gulf of Alaska, 15 species are known to breed in coastal areas:

- short-billed dowitcher mallard
- surfbird green-winged teal
- rock sandpiper shoveller
- ruddy turnstone Barrow's goldeneye
- red phalarope bufflehead
- whimbrel harlequin
- common snipe scoter
- black-bellied plover red-breasted merganser
- long-billed dowitcher pintail
- dunlin American wigeon
- western sandpiper common goldeneye
- black turnstone greater scaup
- northern phalarope oldsquaw
- wandering tattler common eider
- American golden plover common merganser

The approximately 700,000 acres of wetlands in the Copper River Delta provide the single largest shorebird nesting area in the region. The Copper River Delta also supports the greatest number of shorebird migrants, with between 10 and 12 million shorebirds passing through the District each spring. Most shorebirds migrate through the area from late April through mid-May, with the peak migration on the Copper River Delta occurring from early to mid May.

In the spring and fall, the Copper River Delta north of the mudflats from Mountain Slough to Glacier River, and the tidal flats north of Grass Island are heavily used by migrating shorebirds. The most

numerous shorebirds include: dunlins, western sandpipers, sanderlings, red knots, black oystercatchers, and surfbirds. Sandhill cranes also stop in the area during spring migration. Fewer shorebirds are present in the region during the fall. Recent studies have indicated that Controller Bay is the primary landfall for shorebirds arriving in the area, with most birds then moving west across the Copper River Delta. Shorebirds are in transit to and from northern breeding grounds and are not present in the District during the summer or winter. However, the Copper River Delta is still the largest breeding area for shorebirds in the Gulf of Alaska; the most abundant breeding species are black oystercatchers and semi-palmated plovers (Cordova CMP 2000 Revision).

Seabirds

Large numbers of breeding seabirds are present at the Copper River Delta from April through September. Small colonies, consisting primarily of glaucous-winged gulls, Arctic terns, and Aleutian terns, are present on all the outer islands of the Delta and along most of the shoreline between Mountain and Mirror River sloughs. The seabird species of greatest abundance are the: black-legged kittiwake, glaucous-winged gull, common murre, tufted puffin, pelagic cormorant, Aleutian tern, and Arctic tern.

Colony sites in the region with the largest numbers of seabirds include: Wingham Island (19,596), Martin Islands (20,276), Southeast Hinchinbrook (2,490), Porpoise Rocks (7,086), Boswell Rocks (3,712), Egg Island (11,020), Strawberry Reef (4,000), East Copper River Delta (2,100), West Copper River Delta (2,428), Pinnacle Rock (8,912), and Middleton Island (154,146) (Cordova CMP 2000 Revision).

Eagles, Hawks, and Owls

Ten species of eagles, hawks, and owls migrate through or inhabit the coast of the Gulf of Alaska year-round. Other species of raptors are present from spring to early fall, including the rough-legged, red-tailed, and sharp-shinned hawks and the golden eagle. The gyrfalcon and American peregrine falcon are rare migrants and visitors to the region. Peale's peregrine falcon feeds primarily on waterfowl and seabirds. This falcon may be found year-round in southern Prince William Sound and the northern Gulf of Alaska.

The most conspicuous raptor in the region is the bald eagle. Single and multiple nest sites are found throughout the Copper River Flats. Concentrations of bald eagles occur on the eastern Copper River Delta and Martin River Slough.

Owls present in the Cordova region include: the great horned owl, a common resident in the forested Copper River Delta; the snowy owl, a rare visitor; the northern hawk owl, an uncommon resident of forested areas; and the great gray owl, short-eared owl, boreal owl, and saw-whet owl.

3.6.3 Terrestrial and Marine Mammals

Both terrestrial and marine mammals are found in the District, and both are dependent on the availability and productivity of coastal habitats. The following information came from the Cordova CMP 2000 Revision.

Terrestrial Mammals

Terrestrial mammals include: Sitka black-tailed deer, moose, mountain goat, black bear, grizzly bear, and smaller furbearers such as lynx, coyote, red fox, muskrat, mink, marten, weasel, marmot, and otter. Moose are present throughout the Copper River Delta, with wintering habitat present in the Ragged Mountains and Martin River area. Optimum winter habitat for moose is dependent on the availability of adequate willow and alder browse.

The populations of Sitka black-tailed deer are relatively limited to the mature forests along the coastal mainland, with higher populations of deer present on Hinchinbrook and Hawkins islands. When snow cover is present at higher elevations, winter foraging occurs principally along coastal beaches. Black-tailed deer are capable of short-term movements between habitats in response to prevailing winds and storm events.

Mountain goats are the only large mammals present above the spruce-hemlock vegetation zone in alpine tundra habitats. Mountain goats may also be present in the spruce-hemlock zone and along the marine coast.

Grizzly bears are present in coastal areas including spruce-hemlock forests, the Copper River Delta, alpine areas above treeline, and on major offshore islands. Black bears prefer habitats that include mature trees and closed canopy forests. Both grizzly and black bears seasonally concentrate along salmon streams during the summer spawning period to take advantage of this readily available food source.

A high-density use area for beaver is located in the wetlands of the Copper River Delta.

Marine Mammals

The most abundant marine mammals in the nearshore waters are the harbor seal, sea otter, sea lion, and harbor porpoise. Large numbers of Dall porpoise, Pacific white-sided dolphin, and northern fur seal occur primarily in the deeper, offshore waters along the continental slope. Whales are regularly found in and migrate through the offshore waters.

Whales

Whales species include: the minke, killer, humpback, fin, sei, and beaked whales. The humpback, fin, and sei whales are classified as endangered species.

Gray whales migrate annually along the coast off the Copper River Delta and Hinchinbrook Island, enroute to and from summer feeding grounds in the Bering Sea. They are commonly observed south of Egg Island, through the area south of Katalla Bay, and northeast of Wingham Island. Gray whales can also be found in the Gulf of Alaska south of Strawberry Point during the summer. Northward migration occurs in April, and southward migration generally occurs in November. The gray whale population in the North Pacific Ocean has recently been removed from the endangered species list due to improvements in its population status.

Harbor Seals

Harbor seals are relatively common in both nearshore marine water and freshwater of the lower reaches of major rivers. These seals are most numerous on the offshore islands of the Copper River Delta during the summer and spring, when they are feeding on migrating salmon that are entering the river. Remote river bars, beaches, and exposed reefs used as areas for pupping in June include Egg Island, Copper Flats, and the flats north of Grass Island Bar. The Bering River and Bering Lake have harbor seals living in a freshwater environment during the summer. Seals have also been observed at Miners and Coghill Lakes. In late summer, some harbor seals are found far upstream in river tributaries and lakes. Major marine concentration areas occur on Kayak Island, on the tidally exposed rocks at Cape St. Elias, and on sandbars bordering Okalee Channel and Okalee Spit.

Important haul-out sites for harbor seals are located on: islands offshore from the Copper River Delta, islands, close to the City in Orca Inlet, Hawkins Island Cutoff, the north side of Hinchinbrook Island, Port Etches, Sheep Point, Gravina Point, and inner Port Gravina. Haul-out areas are located at: the southern

end of Castle Island, the northern end of Kokinhenik Bar, the mouth of the Martin River, the area north of Storey Slough, and throughout the sandy areas near Cottonwood Point.

Sea Otters

Shallow nearshore waters within the diving capabilities of sea otters are the preferred habitat for foraging for a variety of mollusks and crustaceans. Although they were hunted extensively during the 19th century, small remnant populations remained in some portions of Prince William Sound. Since protection for this species was established, they have increased in numbers and, since the early 1980's, eastern Prince William Sound populations have increased dramatically. Sea otter populations in portions of Prince William Sound were adversely affected by the Exxon Valdez oil spill.

Steller Sea Lion

The Steller sea lion is a wide-ranging inhabitant of the northern Gulf of Alaska and eastern Prince William Sound. An important haul-out area, designated as Critical Habitat under the Endangered Species Act (ESA), is located at Hook Point on eastern Hinchinbrook Island. A sea lion haul-out site is present at Cape Hinchinbrook, and a pupping rookery, also designated as Critical Habitat under ESA, is situated at Seal Rocks in Hinchinbrook Entrance. Seasonal movements of sea lions to the nearshore waters in Orca Inlet and the Copper River Delta are associated with the occurrence of herring and salmon migrations in the area.

3.6.4 Coastal Habitats

Coastal habitats in the District are categorized as: offshore coastal habitats; barrier islands; lagoons; wetlands; tideflats; rocky islands; seaciffs; exposed high energy coasts; and, rivers, lakes, and streams. These habitats are discussed below.

Offshore Coastal Habitats

The offshore coastal habitats of the District include estuaries, wetlands, and tideflats. The coastline is incised and variable and includes large bays and a major river delta and offshore barrier island system associated with the Copper River Delta. Offshore areas include the marine habitats seaward of mean lower-low water to the District boundary. Although direct applicability of the CMP extends only to the 3-mile limit of state jurisdiction, activities and resource uses occurring beyond that boundary could affect resources within the 3-mile limit.

Freshwater discharges from rivers and coastal marine currents provide nutrients for the offshore coastal habitats. The character of the inertial and sub tidal substrate (rock, gravel, sand, or mud) influences the productivity of the near shore habitats in terms of plant production, use as nursery areas by fish and shellfish, and feeding areas for waterfowl and shorebirds.

Offshore areas provide habitat for a wide variety of fish, shellfish, seabirds, waterfowl, and marine mammals. They also serve as migration routes for salmon, whales, and other marine fish and mammals. Offshore areas are critical to the maintenance of the commercial and subsistence/personal use fisheries of the region.

In the District, estuaries are represented by bays at the mouth of rivers, marine waters behind enclosing barrier island systems, and upstream in rivers and streams to the limit of saltwater intrusion (high tide influence). An estuary is a semi-enclosed body of water having an opening to the sea, and containing a measurable quantity of salt. Due to the unique mix of freshwater and saltwater, estuaries are vital rearing and feeding areas for fish and shellfish, waterfowl, seabirds, marine mammals, and benthos invertebrates.

Shallow estuarine waters with soft substrates also provide the growing conditions for plants important to marine fish and invertebrates, birds, and mammals. Estuaries are crucial to the maintenance of salmon populations since outmigrating smolts (sockeye, king, and coho salmon) and fry (chum and pink salmon) frequent estuarine waters near shore during their early stages of growth in the ocean. During spring and fall migrations through the District, millions of migrating waterfowl, geese, and shorebirds stage and feed in the Copper River Delta area.

Barrier Islands and Lagoons

In areas where sand, gravel, or mud has accumulated in low-lying peninsulas or spits across the mouth of bays, inlets, river deltas, or other coastal embayments, barrier island and lagoon habitats can be formed. The accumulation of sediments that form the barrier islands or spits, may be due to long-shore ocean transport of materials by currents or wave action, or deposition from stream or river outflow. The important characteristic is that these fragile systems shelter the water contained behind them in semi-protected lagoons, while maintaining a continuous or intermittent exchange of water with the sea.

Barrier island lagoons are estuarine in nature (contain a mix of both freshwater and saltwater) and are often several times as productive as adjacent marine waters. Lagoons provide vital molting and staging areas for migrating waterfowl and shorebirds, and important feeding areas for birds, seals, and fish. Barrier islands are used by some birds for nesting, as haul-out and pupping areas for seals, and as beach spawning habitat for some marine fish species. Barrier islands and offshore bars protect the inner coastline from the direct actions of excessive wave erosion.

Wetlands and Tideflats

The Copper River Delta comprises approximately 700,000 acres of productive wetland and tideflat habitats. Freshwater wetlands are those areas characterized by rooted vegetation, which is partially submerged continuously or periodically by freshwater with less than 0.5 parts per thousand salt content and not exceeding 9-10 feet in depth. Saltwater wetlands are defined as coastal areas characterized by saltwater tolerant vegetation (halophytic hydrophytes) and macroalgae extending from extreme low tide to areas above high tide, which are influenced by sea spray or tidally-induced water level changes.

Wetlands are vitally important habitats used for nesting, rearing, molting, and staging areas by migratory birds; spring feeding areas for grizzly bears; and rearing areas for resident fish and freshwater rearing stages of anadromous fish. Wetlands also sustain small mammal and furbearer populations, replenish and regulate stream flow, contribute to the maintenance of water quality in lakes and streams, and provide an important source of organic nutrients to estuaries and coastal waters. Shallow estuarine waters are commonly the site of valuable, saltwater wetland habitats.

Tideflats are intertidal areas alternately covered and exposed by rising and falling tides. Depending on the location, the substrate of tideflats can vary from mud to well-sorted sand and gravel. Exposed tideflats support a low to moderate level of plant and animal life, while sheltered tideflats are commonly more productive and support extensive plant and animal communities, including benthic communities in the tideflat muds.

Rocky Islands and Seacliffs

Rocky islands, seacliffs, offshore rocks, and capes serve as pupping, breeding, and haul-out areas for seals and sea lions, and as preferred breeding and nesting areas for seabirds and raptors. In the District, rocky islands and seacliffs are generally restricted to exposed headlands and some islands.

Exposed High Energy Coasts

Exposed high-energy coasts are defined as open and unprotected sections of the coastline directly exposed to high-energy ocean waves. These dynamic coastlines are characterized by eroding sections of shoreline and beaches formed by the deposition and erosion of sand and gravel. Exposed high-energy shorelines usually have moderate to steep gradients and a rock/bedrock substrate that erodes very slowly. High-energy coasts are subject to the direct influences of storm surges, coastal flooding, and movement of sand and sediment along the shoreline.

High-energy rock shorelines support healthy and productive marine habitats characterized by algae, rockweed, mussels, barnacles, snails, seastars, and other invertebrates. Eelgrass sometimes occurs in the lower reaches of intertidal and nearshore areas. Along high-energy coastlines, bedrock and large boulder shorelines are usually more productive than intertidal areas composed of smaller boulders, cobble, gravel, sand, or silt because the smaller size substrate materials are less stable under wave and water impacts.

Rivers, Lakes, and Streams

In the District, rivers, streams, and lakes comprise the freshwater drainage systems of the region. Lakes and ponds can function as settling basins for sediments, and are capable of moderating the effects of rapid runoff by stabilizing downstream flows. Rivers and streams in the District include: large rivers such as the Rude and Copper, which extend many miles inland and cover extensive watersheds; numerous shorter rivers that originate in snowfields and glaciers at higher elevations; and very abbreviated streams with small drainage basins, particularly on large offshore islands such as Hawkins and Hinchinbrook. These drainages support runs of anadromous salmon and steelhead, and resident cutthroat trout and Dolly Varden. Beavers, muskrat, river otters, and other small mammals are dependent on these water bodies and their riparian zones.

Important Uplands

Important uplands are all the areas within the District not included in the habitat descriptions above. This habitat includes extensive vegetated and unvegetated upland areas, forested lands, and important riparian areas along streams and rivers. Important uplands are also the headwater areas for rivers and streams, and valuable habitats for wildlife populations.

Vegetation

The District is predominately a western hemlock/Sitka spruce vegetation type, interspersed with wetlands, rivers, lakes, and streams. The forested vegetation is absent above approximately the 1,000-foot elevation contour in the lowlands of the Copper River Delta, and in lowland areas near Gravina Point and Knowles Head. The 1964 Alaska Earthquake caused uplifting in the District, which resulted in changes to the vegetation patterns.

3.6.5 Resource Sensitivities

The topography and geographic features of the District concentrate productive habitats along valley stream and lakes systems, lagoons and estuaries, and vegetated intertidal and subtidal areas along the shoreline. Other habitats are important for certain life history functions of birds and wildlife, such as marine mammal haulout areas, and seabird nesting colonies.

Impacts to Commercial Fishing, Recreation, and Tourism

Commercial fishing is a major component of the economy of Cordova. Commercial fishing activities are sensitive to the health of fisheries stocks and their habitat, loss of access to fishing areas, contamination

and loss in confidence in the seafood product, and associated social and economic effects. Fish are sensitive to disturbance from human activities, and may be extremely vulnerable in certain areas or during certain times of year (spawning, rearing, and migration). Damage to spawning and rearing habitat, and blockage of fish migration in anadromous fish streams are of particular concern. Other species, such as shellfish, may not be able to leave an area of disturbance. Blockage of fish movements and migration within a stream, or along the marine shoreline, can occur as a result of physical obstructions, water velocity, thermal barriers, or pollution. When these movements and migrations are disrupted, adverse consequences to the fish population may be significant.

In addition, recreation and tourism represents one of the fastest growing economic sectors in the Cordova area. Activities such as wildlife viewing, guided hunting and fishing, boating charters, and seasonal use lodges, occur in Cordova, eastern Prince William Sound, and in the Copper River Delta. A sound and prosperous recreation and tourism economy depends on the health of the coastal resources upon which these uses depend. There are also concerns with impacts from additional recreation and tourism activities. These concerns include: perceived competition with local sport hunting/fishing and subsistence users, associated effects on harvest limits, competition for harbor and waterfront space, decreasing quality of recreation experience due to overcrowding, and disturbance effects on fish and wildlife.

Land Development Impacts

Typical concerns associated with residential, commercial, and industrial development include loss of terrestrial habitat, onsite sewage disposal problems and effects on water quality, and vegetative clearing and erosion problems, particularly adjacent to anadromous fish streams.

Shoreline Modifications

Impediments to marine and freshwater in-migration and out-migration can occur from shoreline modifications that intercept or trap migrating fish, or drainage structures across anadromous fish streams that do not adequately provide for upstream movements of adult fish, and downstream movements of salmon smolts or fry. Inappropriate or incorrectly installed drainage structures at road crossings can block fish passage. Culverts, the most commonly used drainage structure, must be correctly installed to allow both adult and juvenile fish to move upstream and downstream unimpeded. If the culvert is not properly set in the streambed, its outlet may be perched above the stream surface, creating a waterfall that impedes passage upstream for many species and age classes of fish. Culverts not properly sized to handle anticipated stream flows are often incapable of passing seasonal high waters. This is particularly important where high levels of precipitation are a common occurrence. Culverts that are too small concentrate the flow of the stream so that the velocity of the water flowing through the corrugated pipe exceeds the swimming capability of fish, especially younger age classes of coho and sockeye salmon, which rear in streams for several years. This situation constitutes a "velocity barrier" to fish passage. Where feasible, bridges are generally preferable to culverts because they allow unobstructed flow of water and passage of fish. However, if bridge supports are placed within a narrow channel, they may constrict flows, increase water velocity, or accumulate debris which could create a barrier to fish movements.

The anadromous fish streams of the Cordova area are sensitive to all types of channel blockage since it is imperative for adults to move unrestricted to their spawning areas. Rearing juvenile salmon (coho, sockeye) also must have unrestricted access to feeding and overwintering areas within the stream systems. Upstream tributaries to the streams may not provide important spawning habitat, but they may provide critical feeding and rearing use areas for juvenile salmonids, thereby underscoring the importance of barrier-free access to those upstream habitats (Cordova CMP 2000 Revision).

Shoreline modifications and facilities occur as part of port and harbor, road, and utility expansion and improvement projects. Typical shoreline structures include: bulkheads, riprap, break-waters, causeways, piers, docks, and bridges. Poorly designed or improperly placed structures may destroy important aquatic or marine habitats, significantly affect personal/subsistence use activities at current and traditional use sites, damage cultural resources, significantly disrupt sediment transport, induce erosion or accretion, or adversely alter tidal circulation patterns. Although the individual impact to fish and wildlife habitats from a single shoreline modification project may not be significant, the cumulative effects of multiple projects need to be considered when evaluating the extent of impact to important marine habitats or fish and wildlife use areas, and recreation and personal use/subsistence harvest activities (Cordova CMP 2000 Revision).

Shoreline structures that extend into marine waters from the shoreline may disrupt natural circulation and tidal flushing patterns of water bodies in the coastal district. The potential for alteration of tidal circulation and the associated effects on transport of sediments or discharged wastes are important considerations of any development activities.

Alterations to Surface Water

Freshwater aquatic habitats in the coastal district support important populations of anadromous fish. Removal of surface or intergravel water from these streams by withdrawal or diversion could have an adverse impact on the quality and stability of salmon spawning and rearing habitats. Clear water streams of the coastal district have been characterized as high quality, consistent flow systems; it is these critical factors that contribute to their value as spawning and rearing habitat for salmon. Salmon spawning areas are particularly sensitive to alterations in water level. Significant reduction of instream flow by appropriation or diversion of water could destroy eggs and alevins incubating in the gravel. Significant reduction of water velocity due to decreased stream flow also may encourage deposition of finer-size bedload materials, thereby reducing the usefulness of the habitat for spawning. In severe situations, low water can prevent spawning salmon from reaching previously usable habitat (Cordova CMP 2000 Revision).

Flooding of spawning areas by high flows can induce increased water velocities, which may alter the size distribution of preferred spawning gravels or destroy incubating eggs and alevins.

Sedimentation Impacts

Sedimentation is the deposition of fine organic or inorganic materials on the bed of a stream, wetland, or marine environment. Sedimentation differs from siltation, which is the suspension of fine particles in the water column. Adverse impacts to stream biota can occur when sedimentation is significantly increased above the ambient level that occurs naturally in the stream system; the introduction of sediments from development-induced erosion or during slow-flow periods could adversely affect stream productivity. Sedimentation can result from flattening the stream gradient, thereby reducing the stream velocity and allowing more material in suspension to settle out. It can also result from introduction of fine material, particularly silts, clays, and organic matter.

Sediment can be introduced into streams from gravel mining, dredging, gravel washing, pipeline trenching, surface runoff from roadways and cleared areas, or runoff from spoil disposal sites. Removal of natural vegetation from stream banks can induce erosion and introduce fine particles into the streambed. Shoreline and intertidal fill activities in marine waters can introduce sediments into adjacent waters if the fill material is not adequately stabilized and protected from erosion by tidal or wave action. When fine-grained materials are used in shoreline fills, the seaward exposed face of the fill is subject to erosion, which could lead to sedimentation of adjacent waters and adverse impact on adjoining marine habitats.

Sedimentation can cover the existing streambed or marine substrate and fill spaces between bottom materials. Sediment can smother fish food organisms such as algae and invertebrates. Emergent vegetation in wetlands, especially saltwater wetlands, is adversely affected by increased sediment. Fines (fine sediment), which infiltrate into stream substrates, can smother incubating salmonid eggs and young fry (Iwamoto et al., 1978). Sessile benthic marine populations such as clams can be adversely affected by sedimentation.

Stream Channel Alterations

Stream channel alterations include straightening and shortening channels (channelization), diverting streams, widening or narrowing streams, changing stream gradients, and removing streamside vegetation. Meandering stream courses are often "straightened" to accommodate road and/or utility alignments, commercial or industrial fill areas, or residential developments. Straightening has the effect of shortening the stream and may increase water velocity due to an increased stream gradient. The meanders in an undisturbed stream system absorb the stream's energy and allow for the creation of pools and riffles. When a stream is channelized, a trough is created, and there are few opportunities for necessary aquatic habitats to form within the "trough" to replace those that have been lost.

Channelization not only affects the hydraulic equilibrium of a flowing water system, but also can have an adverse effect on stream biota, the distribution of streambed materials, stream temperature, and the upstream migration of spawning salmon. Narrowing a stream channel by making it deeper may increase stream bank erosion and decrease food organism productivity within the channel. Stream diversions involve moving stream flow to another channel or precluding a stream from utilizing its entire floodplain. Diversions of streams often are proposed where development activities such as roadways, mining, cleared areas, or fill for pads, attempt to re-route a natural stream course around or away from the development area. Diversions may be temporary or permanent, but in either case stream depth, gradient, and velocity are subject to change with attendant alterations to the characteristics of the fish habitat. Small, clear-water meandering streams are sensitive to channel modifications, although all streams are susceptible to adverse impacts from alteration of stream hydraulic characteristics.

Siltation Impacts

Siltation, or turbidity, is the addition of suspended solids to freshwater or marine aquatic systems. Long-term excessive turbidity above naturally occurring levels or at times of the year when aquatic systems are generally clear can adversely affect overall stream or marine environment productivity, primarily by reducing light penetration important to photosynthesis. When turbidity levels, over the long term, are high, stream productivity begins to decline rapidly. The sunlight filtering effect of siltation can diminish the photosynthesizing abilities of plants, ultimately reducing the productivity of the entire aquatic system (Hall and McKay, 1983).

Turbid water also can result in an increase in stream temperature. The suspended particles in turbid water absorb more radiation from the sun than clear water, initiating changes in stream temperature that can affect the dissolved oxygen content and subsequently the ability of the stream to support fish. Short-term changes in turbidity do not have a proven adverse effect. Streams that empty into the marine waters of the coastal district are generally clear water systems that do not normally carry any significant amount of suspended particles, except briefly during storm runoff events. Long-term significant siltation of freshwater aquatic systems is potentially most detrimental in productive habitats such as anadromous fish streams, which support spawning, rearing, and feeding fish (Iwamoto et al., 1978). Effects of increased silt and sediment loads on fish and shellfish include interference with respiration and reduced visibility, which can interfere with feeding activities. In addition, salmon may avoid turbid spawning areas (Bisson and Bilby, 1982; Lewbel, 1983). Even where fish resources are not directly impacted by siltation,

associated impacts of reduced photosynthesis, increased water temperature, and reduced dissolved oxygen may decrease the value of aquatic systems to fish (Bjornn et al., 1977) (Cordova CMP 2000 Revision).

Disturbance of Wildlife Populations

During construction and operation of development sites and facilities, the physical presence of equipment, machinery, ships, motor vehicles, and human beings can discourage or preclude the use of specific sites or areas important to wildlife populations. Wildlife species in the District most susceptible to activity disturbance are ducks, geese, shorebirds, seabirds, harbor seals, and sea lions. Ducks and geese are present in the coastal district in largest numbers during spring and fall migration, and during winter feeding and resting. The critically important resting and feeding activities that occur at these times could be adversely affected by development activity if the disturbance is such that the birds are prevented from utilizing feeding and resting areas. Some ducks that nest and summer in the District may acclimate to the sights and sounds around them, while others may remain sensitive to disturbance.

Harbor seals, sea lions, and nesting seabirds use rocky cliffs and beach habitats in the coastal district for haul-out, resting, and nesting. Although some acclimation to development activity can be expected, these species are generally more sensitive to activity disturbance since their use areas are discrete and substitute habitats are not readily available. Some marine mammals have been shown to be vulnerable to disruptions caused by development activities. Helicopters, low-flying aircraft, boat traffic, and human presence have been associated with pup mortality and declining use of some habitats by marine mammals. Johnson et al. (1989) has compiled a synthesis of information on the effects of disturbance and noise on sea lions and harbor seals.

Development activities in flat terrain or areas devoid of visual barriers may be more disturbing to wildlife species than similar activities conducted where topography or vegetative buffers obscure visibility. During construction and operation of development facilities, noise generated by machinery, heavy equipment, and blasting produces varying degrees of disturbance to wildlife. During operation, noise sources may decrease and/or change to sustained or continuous levels. The characteristics of noise vary with its amplitude and frequency, and whether it is pulsed or non-pulsed. Potential disturbance to wildlife can occur from both airborne and underwater noise.

Marine and terrestrial wildlife disturbed by noise may discontinue use of preferred haulout, breeding, feeding, nesting, staging, or wintering areas. The availability of seasonal use areas that provide specific life history requirements may be limited; hence, loss of habitat due to noise disturbance can affect reproductive success and the viability of specific wildlife populations. As an example, preferred shoreline resting and feeding areas used by wintering emperor geese have been subjected to encroachment by shoreline facilities and increased noise and activity disturbance in recent years. Wildlife may be adversely affected by loud and unpredictable noise (startling sounds). Nesting waterfowl and seabirds are particularly vulnerable to startling noises that can result in direct mortality to eggs and young through destruction, abandonment, or increased susceptibility to predation during the absence of the parent bird. Egg mortality also can occur when exposed eggs become overheated or chilled after parents have been driven from the nest. Molting birds may be vulnerable to noise disturbance since they are already under considerable physiological stress during their flightless period. Birds on staging areas are actively feeding to replenish fat reserves lost during spring migration (and prior to nesting) or preparing for extended migrations south in the fall. Loss of access to these important seasonal feeding and resting areas due to noise disturbance may seriously affect productivity and survival of adult birds.

Terrestrial Habitat Alteration and the Loss of Terrestrial Habitat

Development activities can impact the terrestrial (non-aquatic) habitats of the Coastal district by altering their productivity, changing the vegetation composition, or converting the habitat to other uses.

Development-related activities that could alter terrestrial habitats include clearing and excavation, material sites, waste disposal and dredge spoil sites, or placement of sand or gravel pads for roads, work pads, port and harbor facilities, residential and commercial developments, and community facilities. Wildlife also may be precluded from using undisturbed habitats adjacent to directly disturbed habitats due to noise or activity that discourages wildlife presence. The alteration or loss of terrestrial habitats are most critical to wildlife populations if important feeding areas or seasonal use areas of limited availability are disturbed.

Disturbance or Disruption to Cultural and Historic Resources

Cultural and historic resources and traditional use sites are sensitive to disturbance and disruption from development activities. Sensitivities include damage of and theft to resources, and interference with traditional activities. Activities with potential to damage resources or result in theft include excavation associated with site preparation and facility construction, dredge and fill, mining and material borrow, water impoundment from hydroelectric facilities, and activities of construction and spill cleanup workforces. Development projects should institute policies to minimize these potential impacts. Coordination and consultation with community elders, city officials, and Native organizations is necessary.

4.0 CHAPTER FOUR ISSUES OF LOCAL CONCERN, GOALS, AND OBJECTIVES

4.1 INTRODUCTION

Cordova is a coastal community and home to a large commercial fishing fleet and fish processing industry. Its strategic location was key to early economic growth associated with fishing and the transshipment of copper ore from the Kennecott Mine in the first half of the twentieth century. The community continues to rely on commercial fishing.

The potential for the expansion of economic uses and activities in Cordova, such as recreation and tourism, is dependent upon coastal resources: fish and wildlife; access to rivers, lakes, and streams; new transportation and utility routes; or new community development. This means that the citizens of Cordova are both resource users and resource managers. In these roles, they participate in decisions concerning the land and water uses and activities in the District.

4.1.1 Issues of Local Concern

The CMP provides a local, state, and federal framework for making decisions on the uses of coastal resources and the activities taking place within the District. Issues concerning resource use and the needs of local residents, businesses, and landowners are the focus of the CMP. Key issues include:

- Maintaining commercial fishing and fish processing,
- Access and use of public lands,
- Recreation and tourism,
- Development of energy resources and facilities,
- Improving transportation and utility facilities and services,
- Personal use/subsistence harvests of fish and wildlife, and
- Minimizing the risk from natural hazards.

In order to address these issues, Cordova has prepared a set of coastal management enforceable policies to encourage responsible development, yet maintain fish and wildlife populations and air and water quality. The policies are specific enough to provide clear direction, yet flexible enough to avoid undue restrictions on property rights. The policies are in keeping with the recently amended ACMP and the provisions of Alaska Statute (AS) 46.39 and 11 AAC 110, 11 AAC 112, and 11 AAC 114.

4.1.2 Goals and Objectives

The goals of the Cordova CMP reflect a wide spectrum of issues pertaining to coastal management and the well-being of Cordova residents, businesses, and landowners. Underlying these goals is the recognition that many Cordovans strive to enjoy economic prosperity and development, and that the foundation of this prosperity is a balanced economy that includes the fishing, recreation/ tourism, and timber industries. While coastal management cannot, by itself, ensure economic well-being, it provides a land and water management framework that supports orderly and sensible development within the constraints of limited land, potential natural hazards, and sensitive habitats. The following issues, goals, and

objectives were developed in 2000 from numerous meetings with the Cordova Planning Commission and the general public. They have been slightly modified to address the requirements of the ACMP, but are generally carried forward for this plan amendment.

4.2 COASTAL DEVELOPMENT

4.2.1 Issues of Local Concern

Most of the development in the greater Cordova area is concentrated along a narrow, low lying divide extending from Odiak Slough east to Eyak Lake and in the foothills of Mount Eyak, which face west across Orca Inlet toward Hawkins. The slopes of Mount Eyak bound the latter area to the north and Mount Eccles to the south. From this central area, thin lines of settlement extend around both sides of Eyak Lake, south along Whitshed Road, and north along Orca Road. Concentrated residential and commercial development has occurred in the Heney Creek area along Whitshed Road, and at the 5.5 and 6.5 Mile areas along the Copper River Highway.

Water-dependent and *water-related* activities are common concepts in coastal management and in federal permitting activities. The terms imply that development on the waterfront should be dependent on or related to access to the water, and that other activities, where practicable, should look for alternative sites away from the waterfront. Cordova has incorporated these concepts into its Waterfront Master Plan. However, developable land within Cordova municipal boundaries is limited due to steep slopes, wetlands, and land ownership, and may be concentrated in waterfront areas. Flexibility must be used when applying coastal management and permitting activities in waterfront areas.

4.2.2 Goals and Objectives

GOAL 1 Balance economic development and resource use while maintaining healthy coastal resources.

Objective A Locate and manage uses and activities to avoid significant adverse effects on the physical, biological, social, and economic environment.

Objective B Develop policy guidance that can be practically implemented and enforced.

GOAL 2 Apply management guidelines in a fair and consistent manner regardless of land and resource ownership.

Objective A Facilitate the local, state, and federal permitting process.

Objective B Develop fair and rational implementation of coastal management policies through the Cordova Zoning Ordinance, Subdivision Ordinance, and other land management tools.

Objective C Ensure that applicable state and federal activities are consistent with the CCMP.

GOAL 3 Obtain greater local participation in the management of coastal resources and related uses and activities in the area that affects local residents.

Objective A Work closely with the state and federal governments to minimize the adverse impacts of state and federal resource development, disposal of interest in lands, and other land management programs.

GOAL 4 Assess the availability of waterfront land and need for potential development.

Objective A Identify future waterfront land and water use needs for all potential development activities.

GOAL 5 Prioritize use of the waterfront to ensure that water-dependent and water-related use requirements are applied to development requests in a rational manner.

Objective A Use innovative development techniques to maximize the use of available land.

Objective B Maximize the use of waterfront lands for water-dependent and water-related uses.

4.3 COASTAL ACCESS

4.3.1 Issues of Local Concern

Public access to coastal resources for both seasonal and year-round use is critical to Cordova's economy and quality of life. Businesses and residents alike depend upon appropriate access to, from, and along coastal waters. Many residents and visitors enjoy hiking, camping, fishing, hunting, picnicking, viewing wildlife, berry picking, and other outdoor recreation activities. Natural features, including scenic views, clean air, fish and wildlife resources, wild land terrain, and recreational opportunities, provide the basis for recreation and tourism activities. Most industries in Cordova require direct access to the water. Access may include roads, trails, waterways, and marine anchorages. As land is subdivided for development, it will be critical to maintain, and even increase, access to coastal water.

4.3.2 Goals and Objectives

Goal 6 Promote and maintain access opportunities to the coastal areas for purposes of recreation, coastal development, transportation and utilities, and commercial and seafood processing.

Goal 7 Promote physical and visual access by obtaining easements, where appropriate, as coastal development occurs.

Objective A Reserve waterfront land for those uses needing direct access to water.

Objective B Improve public access to developed and undeveloped public waterfront areas on the road system.

4.4 RECREATION

4.4.1 Issues of Local Concern

The Cordova area, including Prince William Sound and the Copper River Delta, is a major recreation and commercial recreation attraction, offering excellent hunting, fishing, wild life observation, and boating opportunities. Resident and nonresident use of these resources supports a local industry consisting of lodge operators, air taxi services, boat and fishing charters, and guiding services. While there may be benefits from increased commercial recreation activities, there can be potential conflicts with private property owners and other resource users. In some cases, the quality of the recreation experience may be changed. Conflicts include trespass on private lands, general disruption of community lifestyle, competition for fish and wildlife resources, overcrowding, and littering. Benefits include increased community facilities, improved community aesthetics, improved transportation access, and an increase in

jobs and the tax base. Maintenance of the long-term viability and high level of quality is desired in the recreation experience in Cordova.

4.4.2 Goals and Objectives

GOAL 8 Ensure the long-term viability and maintain a high level of quality in the recreation experience in Cordova.

Objective A Identify potential sites for public use located in traditionally used recreation areas on public lands.

Objective B Support development of recreational facilities in designated areas on public lands and on private lands where the landowner is agreeable.

GOAL 9 Ensure that the adverse impacts resulting from public and private recreation and/or tourism uses and activities are minimized and/or mitigated.

Objective A Evaluate the impact of commercial recreation and/or tourism development on sensitive fish and wildlife populations and habitat, cultural resources, and water quality.

Objective B Assess cumulative impacts and identify existing and potential carrying capacity considerations associated with commercial recreation/tourism development in the Cordova area.

Objective C Encourage responsible remote recreation development, including alternatives on public lands such as concentrating commercial recreation/tourism development in nodes or clusters at selected locations.

4.5 NATURAL HAZARDS

4.5.1 Issues of Local Concern

Cordova, like other areas of Alaska, is likely to be subject to future earthquakes, marine landslides, flooding, avalanches, erosion, and wind damage. The potential for geophysical hazards should be assessed prior to coastal development.

4.5.2 Goals and Objectives

GOAL 10 Provide for public safety and minimize exposure to danger when developing coastal areas.

Objective A Use available data concerning seismic, avalanche, erosion, flood, and wind hazards in development design.

Objective B Incorporate appropriate development criteria into local land use regulations to minimize the impact of these hazards.

Objective D Require sound engineering and construction practices to ensure the safe siting, design, and construction of public and private facilities.

Objective E Work with property owners to prepare best management practices for the siting and design of development in hazard-prone lands, or in designated Natural Hazard Areas.

4.6 CULTURAL, ARCHAEOLOGICAL, AND HISTORIC RESOURCES

4.6.1 Issues of Local Concern

The Cordova area has been used by a number of cultures, including the Chugach Eskimos, Eyak Indians, Russian explorers and colonists, and later, immigrants of American and European descent. As a result, the number of known, and potential, cultural and historical resources are significant and can make a valuable contribution to understanding the past. Without proper care, sites and artifacts of this rich heritage are subject to potential damage from development activities, looting or vandalism, and natural erosion.

4.6.2 Goals and Objectives

GOAL 11 Preserve the cultural, ethnic, and historical values of the Cordova area.

Objective A Develop and implement siting and construction procedures to avoid damage to cultural and historical resources on public and private lands where federal permitting, licensing, funding, or technical assistance is involved.

Objective B Support increased enforcement of regulations that protect archaeological resources and sites.

Objective C Encourage public awareness of the existence of archaeological and historic resources in the region and the harm created by disturbance or vandalism.

4.7 SAND AND GRAVEL RESOURCES

4.7.1 Issues of Local Concern

Cordova served as the port for shipping processed ore from the Kennicott Copper Mine to market until the mine closed in the 1930s. Current mining activities are mainly associated with extraction of sand, gravel, and rock for road, marine facility, and construction fill material. While mining has not been a significant issue in Cordova, traditional concerns usually consist of reclaiming sites upon completion of use, potential impacts to stream hydraulics and anadromous fish streams when mining occurs in floodplains, and conflicts with adjacent land uses from noise, dust, and truck traffic.

4.7.2 Goals and Objectives

GOAL 12 Provide opportunities for environmentally sound mineral resource exploration and extraction, and support development of sand and gravel resources to facilitate local development.

Objective A Identify potential mineral deposits within the Cordova planning area.

Objective B Work with public and private mineral owners to identify potential needs for and sources of sand and gravel for community expansion.

GOAL 12 Mitigate potential adverse impacts from mineral exploration and sand and gravel extraction activities.

Objective A Develop recommended guidelines for exploration and extraction of sand, gravel, and other minerals to avoid, or minimize, adverse impacts to fish and wildlife, cultural resources, air and water quality, and other land uses.

Objective B Evaluate requirements for annual and end-of-project reclamation activities for mineral extraction activities.

4.8 TRANSPORTATION AND UTILITIES

4.8.1 Issues of Local Concern

Because of the mountainous topography, availability of suitable space on public lands in the Cordova area for locating transportation facilities is low. The cost of building such facilities is high. At other facilities, such as airstrips, operations can be severely constrained by weather. Maintenance of existing facilities also can create economic problems. All of these factors contribute to high construction and maintenance costs for transportation facilities in the District.

In the case of some of the existing facilities, such as boat harbors and the port, the current capacity is inadequate to meet demands, thereby supporting the need for new facilities such as those proposed at Shepard Point. Physical access to Cordova has been an important issue for Cordova.

Once a major steamship stop on the route from Seattle, Cordova was once the marine terminus for the Copper River Railroad. However, the closure of the Kennecott Copper Mine and uplift caused by the 1964 earthquake reduced Cordova's transportation role in the region. Changes in air travel have also occurred. This change and the lack of an overland connection between Cordova and other parts of Alaska and the cost of transporting goods, affects economic development opportunities available to the community.

Airport

The community has a large airport with a paved runway capable of handling jet traffic. Cordova enjoys daily jet service to Anchorage, Juneau, and Seattle, as well as two to three commuter flights to Anchorage daily – depending upon the season. The community is also served by a number of air charter services.

Ferry

The Alaska Marine Highway serves the community. Beginning in the middle of September 2004, Cordova will be serviced by the M.V. Tustumena and/or the M.V. Kennecott. Beginning in May 2005, the M.V. Chenega will provide Cordova with daily service to Whittier and Valdez, this vessel will be home ported in Cordova. The nearest road link to the rest of the state is Valdez; a community located 65 miles to the northwest.

Roads

Several alternatives for improved road transportation access are under consideration. Development of a Copper River Highway was initiated in 1935 and reconsidered under the Hickel administration, but is currently suspended. Other road connections from the Richardson Highway have also been proposed; however, local opinions on the road project are strong and split down the middle.

Port

The 1964 earthquake ended Cordova's capacity to serve as a deep-water port. Cordova is currently working on re-establishing itself as a deep water port by building new port facilities at Shepard Point in Nelson Bay; an area approximately 6 miles north of the current port area. The proposed Shepard Point Road and deepwater port would improve marine access to Cordova and oil spill response within Prince William Sound.

Water, Sewer, and Solid Waste

Adequate water, sewer, and solid waste facilities are also an important need. Inadequate facilities contribute to health problems and air and water pollution. Improperly controlled landfills create an attractive nuisance for wildlife, such as brown bears. Dumping of marine trash and provision of improved harbor and solid waste facilities are issues in Cordova.

4.8.2 Goals and Objectives

GOAL 13 Improve transportation access in a manner that minimizes or mitigates adverse social and environmental impacts to the Cordova area.

Objective A Support improvement of basic transportation needs of the community.

Objective B Provide guidance to marine and surface transportation improvement projects that minimize or mitigate adverse social and environmental impacts.

GOAL 14 Provide reliable water supplies and sewage treatment systems.

Objective A Support upgrades to water supply systems to reduce water loss and provide adequate water distribution.

Objective B Work to improve public and private sewage disposal systems to minimize water quality problems.

GOAL 15 Improve marine waste and solid waste disposal services and facilities.

Objective A Support the development of waste disposal facilities to handle harbor trash, waste oil, vessel sewage, and recycling.

Objective B Improve the solid waste/landfill facilities in Cordova.

Objective C Work with state, federal, and local agencies to identify, fund, and implement options to dispose of marine wastes.

4.9 FISH AND WILDLIFE RESOURCES AND HABITATS

4.9.1 Issues of Local Concern

The fish and wildlife of Cordova, Prince William Sound, and the Copper River Delta draw on the diverse habitats of the region and are important to the local residents in many ways. Anadromous fish, marine fish, and shellfish support a major portion of the economy of Cordova. Fish and wildlife also are utilized for personal use, sports and subsistence harvests, and as an attraction for visiting tourists. Some species, such as marine mammals, anadromous fish, and certain raptors and waterfowl, are protected under federal and state laws.

River valleys, upland forests, shorelines, and near shore waters contain important habitat for various life history stages of fish and wildlife, and are often the areas used for commercial, personal use, sports, and subsistence harvests. As development and use occurs, there is potential for adverse effects on fish and wildlife through the direct detrimental effects from deterioration of water quality, increased human use, and adverse changes in habitat. There are areas of particular importance or sensitivity, such as fish spawning habitat, where fish and wildlife use should be protected in a reasonable manner.

The distribution of fish and wildlife and use of habitat becomes a consideration for harbor and waterfront development because of local, state, and federal regulatory requirements and concerns. The review of

applications for state and federal permits includes an assessment of potential affects on fish and wildlife. Depending on the outcome of the assessment, a developer may be required to modify a project to avoid or mitigate adverse effects as a condition of receiving a permit. However, it is sometimes difficult to obtain consensus between applicants and state and federal agencies on appropriate mitigation measures.

4.9.2 Goals and Objectives

GOAL 16 Protect coastal habitats and maintain fish and wildlife populations through management of lands and waters and development activities.

Objective A Work with appropriate state and federal agencies, as well as other land owners where agreeable, to identify and protect important coastal and marine habitats.

Objective B Identify the appropriate level of intensity and density levels for development activities in those areas with important habitat values and sensitivity.

Objective C Identify functional and legal requirements for buffers, structural setbacks, and other development standards in order to minimize and mitigate the potential impacts from projects.

GOAL 17 Protect slope stability when developing upland areas.

Objective A Minimize or mitigate clearing and other disturbance of vegetation during development in upland areas where mass wasting is an identified hazard, in a designated Natural Hazards Area, or where it can be reasonably anticipated.

Objective B Provide adequate drainage of surface runoff when developing upland areas.

Objective C Consider soil suitability and limitations in the design and siting of development.

Objective D Keep off-road vehicular use to a minimum in steep areas sensitive to erosion.

4.10 COMMERCIAL FISHERIES AND SEAFOOD PROCESSING

4.10.1 Issues of Local Concern

The fish resources of the Cordova area are currently one of the economic mainstays of many local residents, and comprise a portion of the personal use and subsistence resources they harvest. Because the viability of fisheries resources is dependent on offshore and onshore habitats, development of other resources has the potential for adverse impacts on fisheries if appropriate safeguards are not taken.

Fish processing also provides significant employment and income to local residents and business owners. Approximately seven processors currently operate in the Cordova area. Onshore processors can be subject to economic constraints associated with changing markets, technologies, and permitting requirements, particularly with regard to processing waste disposal. The fish processing industries should be supported with appropriate incentives and the use of new technologies for processing, and waste reduction and disposal should be explored.

4.10.2 Goals and Objectives

GOAL 18 Support the local commercial fishing industry in their efforts to maintain the economic and environmental health of Cordova regional fisheries.

Objective A Encourage the maintenance of marine and freshwater habitat areas that support commercial fisheries, and promote the rehabilitation of former biologically productive marine and freshwater habitats.

Objective B Where interest is shown, support shellfish mariculture development that complements or does not adversely impact existing resources and the economy.

GOAL 19 Minimize conflicts between fisheries and other development activities.

Objective A Promote mechanisms that mitigate conflicts between fisheries and other natural resource developments.

Objective B Support scientific research and analysis to understand the effect of various development activities on fisheries resources and habitats.

4.11 AIR, LAND, AND WATER QUALITY

4.11.1 Issues of Local Concern

Cordova is fortunate to have relatively good air and water quality. Clean water is especially important in supporting fishery resources and providing the City with a water supply. Sources of existing and potential pollution include old and new fuel spills, ineffective septic systems, landfills, road runoff, and seafood processing wastes. Petroleum spills from large and small vessels are also a current and potential source of marine water pollution. Potential sources of air pollution are highly localized and do not appear to be a significant concern.

The environmental quality of areas and resources used by Cordova residents suffered greatly as a result of the *Exxon Valdez* oil spill. There continues to be concern about the persistence of oil and long-term effects of the spill. While additional safeguards have been implemented since the spill, tankers continue to pass through waters near Cordova en route to west coast refineries. The possibility of additional spill events still exist, and Cordova residents must remain involved in planning for oil spill prevention, response, and clean up.

4.11.2 Goals and Objectives

GOAL 20 Protect and maintain air and water quality through the use of siting, design, and construction techniques for development activities.

Objective A Require a buffer or development setback around lakes and streams for activities related to fuel storage and waste disposal.

Objective B Identify methods for providing potable water supplies, and methods for sewage and solid waste disposal for residents and vessels of Cordova.

Objective C Require, as part of the municipal subdivision approval process, documentation that proposed septic systems, or a state-approved alternative system, can provide safe, long-term disposal of wastewater.

Objective D Support development of new practices to reduce discharge and accumulation of finfish processing wastes into the marine environment.

Objective E Identify water quality research needs, such as effects of process water discharge and persistence of waste discharge accumulations.

GOAL 21 Strengthen community involvement in local and regional oil spill prevention, response, and cleanup plans.

Objective A Work with the oil and gas industry in their preparation of oil spill contingency plans, which provide for in-region capability to prevent and respond to spill events.

Objective B Support additional and improved bulk fuel storage facilities, development of adequate local and regional spill response capability, and improved fuel delivery to fuel storage facilities.

Objective C Discontinue fuel spillage that contributes to water quality problems in Eyak Lake.

4.12 TIMBER RESOURCES

4.12.1 Issues of Local Concern

Timber has been harvested near Cordova since the beginning of the twentieth century. Timber resources were the main criteria in land selections by the Eyak and Chugach Alaska corporations, and timber harvesting has been a promising economic activity for corporation shareholders.

The Alaska Forest Resources and Practices Act addresses timber harvest practices on private lands and satisfies coastal consistency review requirements for state and federal approvals. The Act attempts to balance private ownership rights with the protection of fish and wildlife resources and water quality that benefit residents of the region area. Cordova currently includes requirements related to timber harvest activities in its zoning regulations.

Timber harvest also provides some employment and income to local residents and businesses. Timber harvest operations can be subject to economic constraints associated with changing markets, technologies, and permitting requirements. Timber harvest should be supported with appropriate incentives, and use of new technologies for more efficient forest harvest should be explored.

4.12.2 Goals and Objectives

GOAL 22 Support timber-harvesting activities that promote local development and economic growth.

Objective A Provide appropriate incentives for more efficient forest utilization.

Objective B Accommodate the transfer of logs across coastal areas in suitable areas and identify water quality, and fish and wildlife research needs.

Objective C Where interest is shown, support local value-added forest products industry development that compliments existing resources and the economy.

GOAL 23 Ensure environmentally-sound timber harvesting activities.

Objective A Require the use of timber harvest practices that maintain important fish and wildlife habitat and mitigate significant adverse impacts to water quality.

Objective B Provide incentives and encourage harvest practices that minimize or mitigate significant adverse aesthetic impacts.

- Objective C Where interest is shown, support local value-added forest products industry development that complements existing resources and the economy.
- Objective D Promote means to mitigate conflicts that may arise between timber harvesting and other natural resource development projects.
- Objective E Work with private landowners by reviewing plans for timber transport along the public road system, in populated areas, and in designated recreation and public use areas to minimize potential adverse environmental impacts and conflicts.
- Objective F Participate in review of state and federal timber harvesting policies and regulations to support safe and responsible timber harvest activities.

4.13 SUBSISTENCE/PERSONAL USE OF FISH AND WILDLIFE

4.13.1 Issues of Local Concern

Many Cordova residents use fish and wildlife resources for personal use and subsistence. In general, residents of Alaska rural communities have been more dependent on subsistence resources due to fewer local employment opportunities, high transportation costs, social and cultural traditions, and preferred diet. Subsistence resources and use activities can be affected by major resource development, such as commercial recreation/tourism, commercial fishing, timber harvesting, and offshore oil and gas development, and by over utilization by subsistence users. The *Exxon Valdez* grounding has shown that oil spills can have a significant adverse effect on subsistence activities.

Cordova recognizes that subsistence use is an important use of the fish, game and plant resources in the region, especially for village residents. In other parts of Alaska, competition is increasing among subsistence users, and sport, commercial, and commercial recreation/tourism users. Subsistence and personal use of fish and wildlife in Cordova also faces increasing competition from other users of the resources. As a result, resource allocation among subsistence, sport, commercial, and commercial recreation/ tourism users is a growing concern.

4.13.2 Goals and Objectives

GOAL 24 Support resident use of local fish, game, and plant resources to meet traditional, cultural, and economic needs, on public lands, and on private lands where agreeable to the landowners.

Objective A Manage fish and wildlife harvests to preserve the opportunity for subsistence and personal use while minimizing private property damages caused by public use of subsistence resources.

Objective B Work with the ADF&G and the USFS to identify areas and resources on public lands that are important to residents and their appropriate management.

GOAL 25 Ensure that land use and development decisions on public lands consider personal use and subsistence resources and activities.

Objective A Work to maintain and improve fish and wildlife habitats important for personal use and subsistence resources.

Objective B Encourage development that avoids, minimizes, or mitigates potential adverse impacts to personal use and subsistence resources and activities.

Objective C Support the use of, and access to, personal use and subsistence resources on public lands.

5.0 CHAPTER FIVE ENFORCEABLE POLICIES

5.1 INTRODUCTION

The policies presented in this chapter are the "rules" of the CCMP. All land and water uses and activities occurring on state and private lands, and federally-permitted activities which affect coastal resources within the Cordova coastal boundary are subject to the policies of the CCMP. Uses and activities must comply with applicable coastal management policies to be considered "consistent" with the District's CMP. These policies are the standards used by all parties participating in the consistency determination process during review of state and federal permit applications (see Chapter 7).

5.2 ADEQUACY OF EXISTING STATE AND FEDERAL LAWS

Under State statutes, the enforceable policies of the District CMP must:

- Be clear and concise as to the activities and persons affected by the policies, and the requirements of the policies;
- Use precise, prescriptive, and enforceable language; and
- Not address a matter regulated or authorized by state or federal law unless the enforceable policies relate specifically to a matter of local concern.

A matter of local concern is a specific coastal use or resource within a defined portion of the District that is:

- Demonstrated as sensitive to development,
- Not adequately addressed by state or federal law, and
- Of unique concern to the District as demonstrated by local usage or scientific evidence.

Under state regulations, District enforceable policies that address matters included in the statewide standards must be a matter of local concern in order to be approved. In regard to the second prong of the test, a specific coastal use or resource is not adequately addressed by state or federal law when: (1) the laws are broad in scope and general in their application and more specificity is needed to address local issues; or (2) a local issue or management goal related to the categories of uses, activities, or areas identified in the statewide standards and designations is not addressed by state or federal law.

In the sections that follow, adequacy is discussed for each matter that is addressed by the Cordova enforceable policies in this chapter.

5.3 COASTAL DEVELOPMENT STANDARD

11 AAC 112.200. Coastal development.

(a) In planning for and approving development in or adjacent to coastal waters, districts and state agencies shall manage coastal land and water uses in such a manner that those uses that are economically or physically dependent on a coastal location are given higher priority when compared to uses that do not economically or physically require a coastal location.

(b) Districts and state agencies shall give, in the following order, priority to:

(1) water-dependent uses and activities;

(2) water-related uses and activities; and

(3) uses and activities that are neither water-dependent nor water-related for which there is no practicable inland alternative to meet the public need for the use or activity.

(c) The placement of structures and the discharge of dredged or fill material into coastal water must, at a minimum, comply with the standards contained in 33 C.F.R. Parts 320 - 323, revised as of July 1, 2003. (Eff. 7/1/2004, Register 170)

5.3.1 Coastal Development Applicability

Enforceable policies apply to development in or adjacent to coastal waters throughout the entire coastal resource district and to shorelines within the Eyak Lake AMSA, which has been designated for recreation and tourism use (see “Coastal Water” Appendix D, Definitions).

5.3.2 Coastal Development Adequacy

Prioritization of Uses

The statewide coastal development standard directs coastal districts to prioritize uses and activities in the coastal area based on whether the uses are water dependent, water-related, or neither – but without an inland alternative. These terms are broad in scope and an enforceable policy that defines which uses or activities in the district fall into each of the three categories is making the broad standard more specific.

Placement of Structures and Discharge of Dredged or Fill Material

The coastal development standard requires compliance “at a minimum” with U.S. Army Corps of Engineers (Corps regulations at, 33 Code of Federal Regulations Parts 320 to 323. These regulations provide the Corps with general permitting authority over the placement of structures and discharge of dredged or fill material into navigable waters; the laws are broad in scope and general in their application. The enforceable policies that relate to this standard provide more specificity to ensure that local issues are addressed.

5.3.3 Coastal Development Enforceable Policies

CD-1. Prioritization of Waterfront Land Use

In accordance with the prioritization requirement set forth in 11 AAC 112.200(b), the following shall be applied to coastal waters and within the AMSA:

- A. The following non-exhaustive list of land and water uses and activities are considered “water dependent.” Such uses are economically or physically dependent upon a coastal location, and as such are given a higher priority than those land and water uses and activities that are not water-dependent:

fish hatcheries; mariculture activities; fish processing; float plane bases; boat harbors; freight, fuel, or other docks; marine-based tourism facilities; boat repair, haul outs, marine ways, and accessory attached housing; remote recreational cabins dependent on water access; and facilities that serve as inter-modal transportation links for the transfer of goods and services between the marine transportation system and the road system.

B. The following non-exhaustive list of uses and activities are considered “water-related,” and thus given a lower priority of use than those previously listed as “water-dependent”: marine retail stores and commercial activities such as hotels, restaurants, and other similar uses that provide views and access to the waterfront.

C. Uses and activities which are neither water dependent nor water-related, but for which there is no practicable inland alternative to meet the public need for the use or activity, receive the lowest priority. Such uses and activities shall be permitted when it is not practicable to develop a site with a water-dependant or water-related use or activity due to shallow bathymetry or unusual lot characteristics such as substandard size, frontage, or steep topography, or when such uses would be inconsistent with zoning.

CD-2. Placement of Structures and Fill in Coastal Waters

A. Piling-supported or floating structures shall be used for construction in coastal waters and lakeshores within the AMSA, unless clear and convincing evidence shows that all of the following conditions exist:

1. There is a documented public need for the proposed activity;
2. There are no practicable inland alternatives that would meet the public need and allow development away from the waterfront;
3. Denial of the fill would prevent the applicant from making a reasonable use of the property;
4. The fill is placed in a manner that minimizes impacts on adjacent uses, public access easements along the shoreline, and water views;
5. The fill is the minimum amount necessary to establish a reasonable use of the property; and
6. Development of the property would support a water dependent use.

B. Placement of piling-supported or floating structures in coastal waters shall be subject to the following standards:

1. Use of structures shall be consistent with the allowable uses on the adjacent uplands. Where multiple uses occur, allowable uses shall be determined by extending the property boundary seaward and perpendicular to the shoreline.
2. Structures shall not be treated with exteriorly applied creosote preservative coatings.

5.4 COASTAL ACCESS STANDARD

11 AAC 112.220. Coastal access. Districts and state agencies shall ensure that projects maintain and, where appropriate, increase public access to, from, and along coastal water. (Eff. 7/1/2004, Register 170)

5.4.1 Coastal Access Applicability

Enforceable policies apply to, from, and along coastal waters throughout the entire District and to, from, and along shorelines within the Eyak Lake AMSA, which has been designated for recreation and tourism use (see “*Coastal Water*” Appendix D).

5.4.2 Coastal Access Adequacy

The statewide coastal access standard is a very broad standard. The enforceable policies related to this standard provide more specific direction for providing appropriate public access to, from, and along coastal water. Alaska Department of Natural Resources (ADNR) access requirements are limited to ADNR tidelands or disposals of interest in state lands. No state or federal laws deal specifically with providing coastal public access irrespective of land ownership.

5.4.3 Coastal Access Enforceable Policies

CA-1. Maintenance of Public Access to Coastal Water

Proposed uses or activities shall not impede or degrade trails, viewsheds, beaches, boat launches, and other modes of access to coastal water and to shorelines within designated recreation and tourism use areas.

CA-2. Increased Public Access

Subdivision of State, University, Mental Health Trust, City, Eyak, and Chugach Corporation lands shall include public access to, from, and along coastal water and shorelines within designated recreation and tourism use areas.

CA-3. Enhanced Public Access

Capital Improvements on or adjacent to publicly-owned waterfront property shall incorporate walkways, shelters, and viewing platforms whenever practicable to increase public access to, from and along coastal waters and shorelines within designated recreation and tourism use areas.

5.5 RECREATION

Refer to the Eyak Lake AMSA, Chapter 6.

5.6 NATURAL HAZARDS STANDARD AND PLAN REQUIREMENTS

11 AAC 112.210. Natural hazard areas. (a) In addition to those identified in 11 AAC 112.990, the department, or a district in a district plan, may designate other natural processes or adverse conditions that present a threat to life or property in the coastal area as natural hazards. Such designations must provide the scientific basis for designating the natural process or adverse condition as a natural hazard in the coastal area, along with supporting scientific evidence for the designation.

(b) Areas likely to be affected by the occurrence of a natural hazard may be designated as natural hazard areas by a state agency or, under 11 AAC 114.250(b), by a district.

(c) Development in a natural hazard area may not be found consistent unless the applicant has taken appropriate measures in the siting, design, construction, and operation of the proposed activity to protect public safety, services, and the environment from potential damage caused by known natural hazards.

(d) For purposes of (c) of this section, "appropriate measures in the siting, design, construction, and operation of the proposed activity" means those measures that, in the judgment of the coordinating agency, in consultation with the department's division of geological and geophysical surveys, the Department of Community and Economic Development as state coordinating agency for the National Flood Insurance Program under 44 C.F.R. 60.25, and other local and state agencies with expertise,

(1) satisfy relevant codes and safety standards; or

(2) in the absence of such codes and standards;

(A) the project plans are approved by an engineer who is registered in the state and has engineering experience concerning the specific natural hazard; or

(B) the level of risk presented by the design of the project is low and appropriately addressed by the project plans. (Eff. 7/1/2004, Register 170)

11 AAC 114.250. Subject uses, activities, and designations. (b) A district shall consider the likelihood of occurrence of natural hazards in the coastal area and may designate natural hazard areas. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

5.6.1 Natural Hazards Applicability and Designations

The applicability of enforceable policies is limited to natural hazard areas designated by the district under 11 AAC 114.250(b) (Volume II, Maps).

5.6.2 Natural Hazards Adequacy

The natural hazards statewide standard provides general appropriate measures for the siting and operation of activities within designated areas. In addition, 11 AAC 114.270(g) allows districts to adopt enforceable policies that will be used to determine whether a use or activity will be allowed within a designated areas. Enforceable policies related to this standard provide specific measures to help minimize impacts within designated areas and to ensure that local issues are addressed. Policies also identify specific disallowed uses within designated areas and the criteria that will be used to determine whether a use will be allowed. Other state and federal laws that deal with development activities in floodplains and other hazard areas are broad in scope and general in their application.

5.6.3 Natural Hazards Enforceable Policies

NH-1. Appropriate Measures

In accordance with the “appropriate measures” requirement set forth in 11 AAC 112.210 (c) and (d), the applicant shall consult with the City to incorporate local knowledge to develop best management practices applicable to the specific conditions at the proposed development site.

5.7 SAND AND GRAVEL STANDARD

11 AAC 112.260. Sand and gravel extraction. Sand and gravel may be extracted from coastal waters, intertidal areas, barrier islands, and spits if there is no practicable alternative to coastal extraction that will meet the public need for the sand or gravel. (Eff. 7/1/2004, Register 170)

5.8 SAND AND GRAVEL APPLICABILITY

Enforceable policies apply to coastal waters, intertidal areas, barrier islands, spits, and practicable alternatives throughout the entire coastal resource district (See *Coastal Waters*, Appendix D Definitions).

5.8.1 Sand and Gravel Adequacy

The statewide sand and gravel extraction standard is a very broad standard. Enforceable policies related to this standard provide specificity for extraction activities. Other state or federal laws that deal with permitting of sand and gravel extraction are broad in scope or limited in application to specific state or federal lands.

5.8.2 Sand and Gravel Enforceable Policies

SG-1. Sequencing of Coastal Extraction and Practicable Alternatives

To the extent practicable, sources of sand, gravel, rock, and other construction materials shall be approved in the following sequence:

- A. Existing approved gravel pits or quarries operated in compliance with state and federal authorizations;
- B. Reuse of material from abandoned development area, unless reuse could cause more environmental damage than non-use;
- C. New upland sites;
- D. Beaches of low habitat values; and
- E. Streams that do not provide fish habitat.

SG-2. Instream Material Extraction

Extraction of sand and gravel from all stream floodplains shall be located and conducted to avoid changes to channel hydraulics and the potential for channel diversion through the extraction site.

SG-3. Best Management Practices for Anadromous Waters

In streams and their floodplains that provide habitat for anadromous fish, the following practices shall be incorporated into the siting, design, and operation of sand and gravel extraction activities:

- A. Clearing of riparian vegetation and disturbance of natural banks shall be minimized;
- B. To the extent practicable, sand and gravel extraction site configurations shall be shaped to blend with physical features and surroundings;
- C. Settling ponds shall be adequately diked or set back from active channels to avoid breaching by a 25-year frequency flood. Effective use of recycled water shall minimize water withdrawal and subsequent discharge of effluent to adjacent lands or waters; and
- D. Equipment storage and operation shall be conducted in a manner that does not release fuel and lubricants into the environment.

SG-4. Reclamation and Restoration

Reclamation of all upland and floodplain extraction sites shall be required unless such reclamation would cause greater adverse impact to the environment than leaving the area un-reclaimed. At a minimum, reclamation shall include the following elements, as applicable:

- A. Topsoil and overburden shall be segregated and stored separately above the 25-year floodplain of watercourses.
- B. At the end of each extraction season, all disturbed areas shall be regraded to stable slopes. Within mean annual floodplains, regrading to ground contours that will not entrap fish nor significantly alter stream hydraulics shall occur at the end of each operating season. Tailings used in the construction of settling ponds and other essential facilities may be retained in place until completion of their use.
- C. At the completion of extraction, all disturbed areas shall be stabilized and revegetated, as appropriate. Restoration shall include the following:
 - 1. All disturbed areas shall be graded to stable slopes that blend with the natural topography;
 - 2. Erosion control measures shall be implemented as appropriate to stabilize the site;
 - 3. Areas designated for revegetation shall be covered with topsoil to encourage establishment of native plant species; and
 - 4. Where material sites that are excavated below groundwater may have value as habitat for waterfowl or fish, the resource agencies shall be consulted on the final design and schedule of the restoration plan.

Excluded from these requirements is the portion of a gravel extraction site required to provide materials for continuing maintenance and operation. Maintenance sand and gravel sites shall comply with the requirements of part b) of this policy.

5.9 HISTORIC, PREHISTORIC, AND ARCHAEOLOGICAL RESOURCES STANDARD AND PLAN REQUIREMENTS

11 AAC 112.320. Historic, prehistoric, and archeological resources. (a) The department will designate areas of the coastal zone that are important to the study, understanding, or illustration of national, state, or local history or prehistory, including natural processes.

(b) A project within an area designated under (a) of this section shall comply with the applicable requirements of AS 41.35.010 – 41.35.240 and 11 AAC 16.010 – 11 AAC 16.900. (Eff. 7/1/2004, Register 170)

11 AAC 114.250. Subject uses, activities, and designations. (i) A district shall consider and may designate areas of the coast that are important to the study, understanding, or illustration of national, state, or local history or prehistory. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

5.9.1 Historic, Prehistoric, and Archaeological Resources Applicability and Designations

Cordova recognizes that the number of known, and potential, cultural, and historical resources are significant and can make a valuable contribution to understanding the past.

The applicability of enforceable policies is limited to those sites on the Alaska Heritage Resources Survey (ARHS) inventory of all reported historic and prehistoric sites within the State of Alaska, and to the District under 11 AAC 114.250(i). The ARHS inventory is maintained by the State Office of History and Archaeology. The ARHS inventory of cultural resources includes objects, structures, buildings, sites, districts, and travel ways, with a general provision that they are over 50 years old. To date over 22,000 sites have been reported within Alaska. For each individual site, the ARHS maintains a site record containing such information as the site name, a description of the physical remains, data on the site's location, and a list of bibliographic citations, as well as a variety of additional information relevant to management and research needs.

5.9.2 Historic, Prehistoric, and Archeological Adequacy

The historic, prehistoric, and archeologic resources standard provides general appropriate measures for the preservation and protection of such resources within designated areas. In addition, 11 AAC 114.250 allows districts to adopt enforceable policies that will be used to determine whether a use or activity will be allowed within the designated area. Enforceable policies related to this standard provide specific measures to help minimize impacts within designated areas and to ensure that local issues are addressed.

5.9.3 Historic, Prehistoric, and Archeological Enforceable Policies

HPA-1 Appropriate Measures

In accordance with the “appropriate measures” requirement set forth in 11 AAC 112.210 (c) and (d), the applicant shall consult with the City, Eyak Corporation, and Chugach Corporation, to incorporate local knowledge regarding the presence of historic, prehistoric, and archeological resources in the designated areas (see Section 5.9.1).

5.10 TRANSPORTATION AND UTILITIES STANDARDS

11 AAC 112.240. Utility routes and facilities. (a) *Utility routes and facilities must be sited inland from beaches and shorelines unless:*

- (1) the route or facility is water-dependent or water related; or*
- (2) no practicable inland alternative exists to meet the public need for the route or facility.*
- (b) Utility routes and facilities along the coast must avoid, minimize, or mitigate:*
 - (1) alterations in surface and ground water drainage patterns;*
 - (2) disruption in known or reasonably foreseeable wildlife transit;*
 - (3) blockage of existing or traditional access. (Eff. 7/1/2004, Register 170)*

11 AAC 112.280. Transportation routes and facilities. *Transportation routes and facilities must avoid, minimize, or mitigate:*

- (1) alterations in surface and ground water drainage patterns;*
- (2) disruption in known or reasonably foreseeable wildlife transit; and*
- (3) blockage of existing or traditional access. (Eff. 7/1/2004, Register 170)*

5.10.1 Transportation and Utilities Applicability

Enforceable policies apply throughout the entire District.

5.10.2 Transportation and Utilities Adequacy

The statewide transportation and utility routes and facilities standards are limited to addressing impacts to surface and groundwater drainage patterns, disruption in known or reasonably foreseeable wildlife transit, and blockage of existing or traditional access. Enforceable policies that relate to these standards provide more specific measures that address route and facilities local issues and concerns. Other state and federal laws that deal with the permitting of transportation and utility routes and facilities are broad in scope and general in their application.

5.10.3 Transportation and Utilities Enforceable Policies

TU-1 Visual Access

Where practicable, overhead lines shall be located in a manner that does not interfere with scenic coastal vistas.

TU-2 Corridor Consolidation and Integration

In accordance with the requirements set forth in 11 AAC 112.240, utility corridors shall, wherever practicable, be integrated with roads and other transportation corridors.

5.11 FISH AND SEAFOOD PROCESSING REQUIREMENTS

11 AAC 114.250. Subject uses, activities, and designations. (f) A district shall consider and may designate areas of the coast suitable for the location or development of facilities related to commercial fishing and seafood processing. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

5.11.1 Fish and Seafood Processing Applicability and Designations

The applicability of enforceable policies is limited to areas of the coast designated by the District under 11 AAC 114.250(f) as suitable for the location or development of facilities related to commercial fishing and seafood processing. Although Cordova recognizes that fish processing provides significant employment and income to local residents and business owners, no areas of the coast suitable for the location or development of facilities related to commercial fishing and seafood processing are designated due to inadequate resources to develop the designations.

5.12 HABITATS STANDARD AND PLAN REQUIREMENTS

11 AAC 112.300. Habitats. (b) The following standards apply to the management of the habitats identified in (a) of this section:

- (1) offshore areas must be managed to avoid, minimize, or mitigate significant adverse impacts to competing uses such as commercial, recreational, or subsistence fishing, to the extent that those uses are determined to be in competition with the proposed use;
- (2) estuaries must be managed to avoid, minimize, or mitigate significant adverse impacts to:
 - (A) adequate water flow and natural water circulation patterns; and
 - (B) competing uses such as commercial, recreational, or subsistence fishing, to the extent that those uses are determined to be in competition with the proposed use;
- (3) wetlands must be managed to avoid, minimize, or mitigate significant adverse impacts to water flow and natural drainage patterns;
- (4) tideflats must be managed to avoid, minimize, or mitigate significant adverse impacts to:
 - (A) water flow and natural drainage patterns; and
 - (B) competing uses such as commercial, recreational, or subsistence uses, to the extent that those uses are determined to be in competition with the proposed use;
- (5) rocky islands and sea cliffs must be managed to:
 - (A) avoid, minimize, or mitigate significant adverse impacts to habitat used by coastal species; and
 - (B) avoid the introduction of competing or destructive species and predators;

(6) barrier islands and lagoons must be managed to avoid, minimize, or mitigate significant adverse impacts:

(A) to flows of sediments and water;

(B) from the alteration or redirection of wave energy or marine currents that would lead to the filling in of lagoons or the erosion of barrier islands; and

(C) from activities that would decrease the use of barrier islands by coastal species, including polar bears and nesting birds;

(7) exposed high-energy coasts must be managed to avoid, minimize, or mitigate significant adverse impacts:

(A) to the mix and transport of sediments; and

(B) from redirection of transport processes and wave energy;

(8) rivers, streams, and lakes must be managed to avoid, minimize, or mitigate significant adverse impacts to:

(A) natural water flow;

(B) active floodplains; and

(C) natural vegetation within riparian management areas; and

(9) important habitat:

(A) designated under 11 AAC 114.250(h) must be managed for the special productivity of the habitat in accordance with district enforceable policies adopted under 11 AAC 114.270(g); or (B) identified under (c)(1)(B) or (C) of this section must be managed to avoid, minimize, or mitigate significant adverse impacts to the special productivity of the habitat.

(c) For purposes of this section,

(1) "important habitat" means habitats listed in (a)(1) – (8) of this section and other habitats in the coastal area that are

(A) designated under 11 AAC 114.250(h);

(B) identified by the department as a habitat

(i) the use of which has a direct and significant impact on coastal water; and

(ii) that is shown by written scientific evidence to be significantly more productive than adjacent habitat; or

(C) identified as state game refuges, state game sanctuaries, state range areas, or fish and game critical habitat areas under AS 16.20;

(2) "riparian management area" means the area along or around a waterbody within the following distances, measured from the outermost extent of the ordinary high water mark of the waterbody:

(A) for the braided portions of a river or stream, 500 feet on either side of the waterbody;

(B) for split channel portions of a river or stream, 200 feet on either side of the waterbody;

(C) for single channel portions of a river or stream, 100 feet on either side of the waterbody;

(D) for a lake, 100 feet of the waterbody. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

11 AAC 114.250. Subject uses, activities, and designations. (h) A district shall consider and may designate portions of habitat areas listed in 11 AAC 112.300(a)(1) – (8) and other habitats in the coastal area as important habitat if:
(1) the use of those designated portions have a direct and significant impact on coastal water; and
(2) the designated portions are shown by written scientific evidence to be significantly more productive than adjacent habitat. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

5.12.1 Habitats Applicability and Designations

The applicability of enforceable policies is limited to important habitat areas designated by the district under 11 AAC 114.250(h). Although Cordova recognizes that the viability of fisheries resources is dependent on healthy offshore and onshore habitats, no areas are designated due to inadequate resources to develop the necessary documentation to support the designations. It is also true that many of the most important habitats are outside the district boundary and could therefore not be designated.

5.13 TIMBER HARVESTING STANDARD

11 AAC 112.250. Timber harvest and processing. AS 41.17 (Forest Resources and Practices Act) and the regulations adopted under that chapter with respect to the harvest and processing of timber are incorporated into the program and constitute the components of the program with respect to those purposes. (Eff. 7/1/2004, Register 170)

5.13.1 Timber Harvesting Applicability

The Forest Resources and Practices Act is incorporated into the ACMP. A district may not write enforceable policies under this standard. Timber harvest and processing is not included within the subject uses that provide the basis for enforceable policies.

5.14 AIR LAND AND WATER QUALITY STANDARD

11 AAC 112.310. Air, land, and water quality. Notwithstanding any other provision of this chapter, the statutes and regulations of the Department of Environmental Conservation with respect to the protection of air, land, and water quality identified in AS 46.40.040(b) are incorporated into the program and, as administered by that department, constitute the exclusive components of the program with respect to those purposes. (Eff. 7/1/2004, Register 170)

5.14.1 Air Land and Water Quality Applicability

Coastal district plans cannot include any enforceable policies that address air, land or water quality. One of the major reforms of House Bill 191 was to effectuate the direct state implementation of the Alaska Department of Environmental Conservation's (ADEC's) air, land and water quality standards. House Bill 191 specifically provides that ADEC's air, land, and water quality standards are the exclusive standards of the ACMP for those purposes.

5.15 SUBSISTENCE STANDARD AND PLAN REQUIREMENTS

11 AAC 112.270. Subsistence. (a) A project within a subsistence use area designated under 11 AAC 114.250(g) must avoid or minimize impacts to subsistence uses of coastal resources.

(b) For a project within a subsistence use area designated under 11 AAC 114.250(g), the applicant shall submit an analysis or evaluation of reasonably foreseeable adverse impacts of the project on subsistence use as part of:

(1) a consistency review packet submitted under 11 AAC 110.215; and

(2) a consistency evaluation under 15 C.F.R. 930.39, 15 C.F.R. 930.58, or 15 C.F.R. 930.76.

(c) Repealed ___/___/2004. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

11 AAC 114.250. Subject uses, activities, and designations. (g) Except in nonsubsistence areas as identified under AS 16.05.258, a district may, after consultation with appropriate state agencies, federally recognized Indian tribes, Native corporations, and other appropriate persons or groups, designate areas in which a subsistence use is an important use of coastal resources and designate such areas. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

The applicability of enforceable policies and the State standard is limited to subsistence use areas designated by the district under 11 AAC 114.250(g). Although Cordova recognizes that subsistence use is an important use of the fish, game, and plant resources in the region, no areas are designated due to inadequate resources to conduct the required consultation. It is also true that many of the most valuable subsistence use areas are outside the District boundary and could therefore not be designated.

6.0 CHAPTER SIX EYAK LAKE AREA MERITING SPECIAL ATTENTION ENFORCEABLE POLICIES

6.1 INTRODUCTION AND DESIGNATION OF EYAK LAKE AMSA AS A RECREATIONAL USE AREA

The Alaska Coastal Management Act and the Guidelines and Standards that implement a local plan allow the establishment of an AMSA. AMSAs may be used in local coastal management plans as a management tool to recognize and protect "areas of unique, scarce, fragile or vulnerable natural habitat, cultural value, historical significance or scenic importance" and "substantial recreational value or opportunity."

In addition, a district may designate areas of recreational use. The entire Eyak Lake AMSA is designated a recreational use area because the area receives significant use by persons engaging in recreation and, in addition, has the potential for increased recreational use because of physical, biological, and cultural features.

6.2 PURPOSE

In recognition of the value of Eyak Lake to the City and Eyak Corporation, the major private landowner in the project area, the AMSA was designated and an AMSA plan was prepared. The AMSA plan was intended to provide for the development of recreational opportunities and maintenance of scenic values associated with Eyak Lake, while maintaining and improving the fishery production and the wildlife habitat values of the lake.

6.3 BOUNDARY

The Eyak Lake AMSA boundary can be described as follows:

On the south, the Copper River Highway from approximately Mile 7 west to the Eyak River Bridge; thence upslope from the south side of the highway to the 500-foot contour line and westerly along the 500-foot contour line to the extended projection of LeFevre Road; thence north along the projection and LeFevre Road and its extended projection to the base of Tripod Hill, which shall form the boundary on the west. The 500-foot contour line beginning at the base of Tripod Hill to a point where it crosses Power Creek above Ohman Falls; thence southerly along the east shore of Eyak Lake to the intersection with the section line between Sections 32 and 33; thence south along the section line to its junction with the Copper River Highway (point of beginning), which shall form the north and east boundaries.

6.4 RESOURCE INVENTORY AND ANALYSIS

The resource inventory and analysis is included with the original AMSA plan in Appendix G.

6.5 PROPER AND IMPROPER USES

Refer to these section headings in Chapter 7: Implementation

6.6 MATTER OF LOCAL CONCERN

Under State statutes, the enforceable policies of the District CMP must not address a matter regulated or authorized by state or federal law unless the enforceable policies relate specifically to a matter of local concern. A matter of local concern is a specific coastal use or resource within a defined portion of the district's coastal zone that is:

- (1) Demonstrated as sensitive to development,
- (2) Not adequately addressed by state or federal law, and
- (3) Of unique concern to the coastal resource district as demonstrated by local usage or scientific evidence.

For a designated recreation area, the "matter of local concern" test does not apply unless a proposed enforceable policy addresses a matter regulated or authorized by some other state or federal law not enumerated in the statewide standards. In this case, there are state and federal laws that may regulate or authorize the activities identified above. However, enforceable policies for an AMSA in effect on July 1, 2004, satisfy the requirements of (1) and (3) above (11 AAC 114.270(i)). Therefore, only (2) above must be satisfied here.

In terms of adequacy, the applicable laws are broad in scope and general in their application; more specificity is needed to determine whether a specific land or water use or activity will be allowed within the AMSA/designated area and to provide the management measures necessary to address the physical, biological, and cultural features of the area and to preserve, protect, enhance, and restore the recreational values (as permitted by 11 AAC 114.270(g) and required by 11 AAC 114.420(d)).

6.7 ENFORCEABLE POLICIES

The enforceable policies in Chapter 5, including those in the Coastal Development and Coastal Access sections, are applicable to the Eyak Lake AMSA.

In addition, the following enforceable policies are applicable within the Eyak Lake AMSA boundary and are necessary to preserve, protect, enhance, or restore the physical, biological, and cultural features upon which the recreational value depends.

6.7.1 Preservation, Protection, Enhancement, and Restoration of Physical Features

- | | |
|------|--|
| EL-1 | Only those uses, which require an over-water location, shall be permitted beyond the ordinary high water mark of the lake or inside the natural wetland boundary. |
| EL-2 | Where practicable, developments in or over the water, such as piers, docks, and protective structures shall be located, designed, and maintained in a manner that prevents adverse impacts upon air and water quality and fish, wildlife, scenic, and vegetative resources. |
| EL-3 | Adequate building setbacks from lake and stream waters and wetlands shall be established and maintained. These setbacks shall be a minimum of 20 feet from any part of a structure to the ordinary high water mark of the lake. Structures in existence at the time of adoption of this plan that are destroyed or damaged may be rebuilt within the existing foundation line. |

- EL-4 Structures or development of uses accessory to residential use (storage shed, well house, garage, etc.) shall retain shoreline open space, be visually and physically compatible with adjacent cultural and natural features, and be reasonable in size and purpose. Such development shall not be permitted in required shore setback spaces, or permitted over water unless clearly water-dependent, such as piers and floats.
- EL-5 The design of structures near watercourses shall preserve stream bank and channel integrity, reduce the impact of flooding, and allow for natural drainage.
- EL-6 The natural water circulation patterns in the lake shall be maintained and essential geo-hydraulic processes of accretion, transport, and erosion shall not be interrupted.
- EL-7 No development shall take place without providing adequate measures to provide for natural surface drainage runoff. Storm water runoff controls sufficient to prevent water quality degradation shall be imposed on development adjacent to Eyak Lake and adjoining tributaries.
- EL-8 Clearing and grading operations shall be conducted in a manner so as to prevent soil erosion and sediment runoff into Eyak Lake and adjoining tributaries. Surface modification that would induce excessive erosion or undermine the support of nearby land shall be prohibited. The developer is responsible for utilizing the best available erosion control measures to minimize erosion and sediment runoff during clearing and construction of a proposed project. The developer will be responsible for submitting a plan to permitting agencies stating how cleared land will be stabilized to prevent future erosion and sedimentation of the lake.
- EL-9 Uplands shall be managed to retain natural drainage patterns and vegetation cover on steep slopes (70 percent or greater), and along shorelines and stream banks to prevent excessive runoff and erosion and protect surface water quality and natural ground water recharge areas.

6.7.2 Preservation, Protection, Enhancement, and Restoration of Biological Features

- EL-10 Maintenance and enhancement of spawning areas shall be given priority consideration for shorelines. Shorelines having banks, beaches, and beds critical to the preservation of the fisheries resource base, as lake and stream spawning areas, shall be maintained in their productive natural condition.
- EL-11 Facilities for storing and distributing fuel shall not be located within the active floodplain of a stream.
- EL-12 In freshwater marshes and wetlands, maintenance of the natural functions is the highest priority. Development is prohibited except where it will not alter the natural functions of fish and wildlife habitat and where it meets a greater long-term public need.
- EL-13 All public works activities such as transportation projects, utilities, sewers, and drainage activities shall protect any freshwater marshes and wetlands from adverse impacts unless there is significant public need for a proposed use or activity for which no practicable alternative exists and all practicable steps have been taken to maximize conformance with the AMSA plan policies.
- EL-14 Adverse impacts to the areas adjacent to the eastern shore of the Eyak Lake from the mouth of Hatchery Creek to the ADF&G weir, including the wetland north of the Copper River Highway and east to the AMSA boundary, shall be minimized to protect the

biological resources principally using this area. These resources include the feeding and resting birdlife – nesting eagles, swans, and loons in particular. Birdlife shall be protected from disturbance, especially from discharge of firearms and motorized vehicles and equipment during freezeup conditions.

6.7.3 Preservation, Protection, Enhancement, and Restoration of Recreation and Scenic Values

- EL-15 Points of recreational and visual access to the shoreline and stream deltas shall be provided and protected, consistent with public safety and private property rights.
- EL-16 The ADOT&PF shall maintain the identified highway pullouts for scenic and viewing purposes.
- EL-17 Recreation and access developments shall preserve or enhance scenic views and vistas, as well as improve the aesthetic value of the area.
- EL-19 Utilities shall be installed underground wherever practicable.
- EL-20 Off-road vehicles such as snow machines, airboats, and 3-wheelers are prohibited on the Power Creek Delta, the wetland adjacent to Southeast Arm, and all lake tributary streambeds, except as necessary for public health and safety and maintenance and patrol of private lands by authorized persons.
- EL-21 Off-road vehicles shall be limited to designated routes and/or areas to ensure protection of users and resource values, and to minimize conflicts.
- EL-22 Eyak Lake waters shall be kept free of hazardous or obstructive development that could create a hazard to recreational use of the waters. In- water structures and buoys shall be visibly marked.
- EL-23 Public beach designations, swimming areas, camping sites, toilets, and picnic facilities shall be established and existing facilities improved where public need warrants and public funding is available.
- EL-24 The following areas and trails shall be retained, classified, and/or managed as recreation resources in accordance with applicable statutory requirements and private property rights. The current managing agency is shown for each area.
 - a) Boat ramp (City) - east end of runway.
 - b) North shore beach (ADNR) - boat launch and picnic area.
 - c) Nirvana Park (City) - picnic and group use.
 - d) The Spit (City) - swimming, picnicking, viewing, floatplane moorage.
 - e) Skater's Cabin (City) - picnic, skating, swimming, trailhead and group use.
 - f) Hatchery Creek culvert crossing (Eyak and ADOT&PF) - spawning fish and bear viewing.
 - g) Power Creek Road turnouts (ADOT&PF) - wildlife and scenic viewing, informal picnicking.
 - h) Power Creek trail (USFS) - hiking and access.
 - i) Crater Lake trail (ADNR) - hiking and access.
 - j) CRH turnouts (ADOT&PF) - scenic viewing.

- k) Mavis Island and causeway (ADNR) - public recreation.
- l) Eyak River Bridge turnout (ADOT&PF) - swan viewing, trailhead for Eyak River Trail, scenic point.

7.0 CHAPTER SEVEN IMPLEMENTATION

7.1 INTRODUCTION

This chapter of the District CMP describes the following:

- City organization;
- Instructions on how to use the CCMP and participate effectively in state consistency reviews;
- Advice to other ACMP network participants about how best to work with the City in implementing this CMP; and
- Provides the people of the City, landowners, and development project applicants with an understanding of how this CMP will be used.

7.2 COASTAL MANAGEMENT PROGRAM PARTICIPANTS' DUTIES AND RESPONSIBILITIES

The City of Cordova, a home rule city, is eligible to be a coastal district in accordance with state law at AS 46.40.210(2)(B).

Local coastal management decisions and actions are the responsibility of the City Council. The Council has delegated ACMP implementation duties to the City Planning Commission and City Planning Director. The Planning Director acts as the CMP Coordinator and is authorized to make decisions and to participate in consistency review and other daily implementation tasks.

The Planning Director works with the Planning Commission, which is an advisory body to the City Council, to implement the CMP. The Planning Director regularly consults with the Planning Commission on matters related to implementation of the CMP. Decisions about large or controversial projects are also brought to the Planning Commission for consideration during the consistency review process. Final Planning Commission recommendations are brought before the City Council for their final decision.

The point of contact for local consistency reviews involving District lands is the Planning Director, who can be reached at:

City of Cordova
P.O. Box 1210
Cordova, Alaska 99574
Phone 907-424-6220
Fax 907-424-6000
Email planning@cityofcordova.net

7.3 CMP PARTICIPANT'S DUTIES AND RESPONSIBILITIES

7.3.1 Planning Commission

The City Council has delegated local implementation of the CMP to the Planning Commission and the Planning Director. The Planning Commission implements the CMP when issuing consistency comments. The Planning Commission normally delegates authority to make consistency comments to the CMP Coordinator. In addition, the Planning Commission has the following responsibilities:

- Monitor and assess consistency comments issued on its behalf by the CMP Coordinator.
- Review this CMP every five years and amend, if required.
- Review every year whether the City is appropriately implementing the CMP.
- Submit the CMP every 10 years to the Office of Project Management and Planning (OPMP) for re-approval. The submittal shall include an evaluation of the CMP effectiveness and implementation, a presentation of any new issues, and a recommendation for resolving any problems that have arisen.

7.3.2 CMP Coordinator

The CMP Coordinator is a member of the Planning Department staff and serves as dedicated staff to the Planning Commission. The CMP Coordinator may also receive oversight and direction from the Planning Commission.

The CMP Coordinator day-to-day responsibilities include:

- Help applicants fill out the coastal project questionnaire including an evaluation of the District's enforceable policies, along with the boundary determination, and educate them about the ACMP and the CMP throughout the process.
- Ensure that information has been received in a timely manner by the parties involved in the consistency review process.
- Determine if information received is complete and sufficient for a consistency review.
- Decide which projects are routine and which projects have great significance to the coastal zone and should be reviewed and discussed with the Planning Commission (routine approvals will be processed by the CMP Coordinator).
- Evaluate uses and activities that require local, state, or federal permits or authorizations for consistency.
- Evaluate proposed projects against the enforceable policies of the CCMP.
- Accurately assess the effect of applicable policies of the CCMP on the application.
- Manage project information to ensure that it reaches all affected persons and organizations.
- Draft effective, concise, and comprehensive consistency determinations and recommendations and produce evidence in support of the conclusions reached.
- Develop draft consistency comments and alternative measures for consideration by the Planning Commission, when necessary.
- Integrate feedback from the local contacts and other interested parties into the City's consistency recommendation.
- Coordinate consistency review activities with adjoining coastal districts where issues or activities of mutual concern are under consideration.
- Prepare and submit the consistency recommendation in a timely manner.
- Prepare quarterly and annual reports to the state, as required by the City's ACMP grant agreement.
- Facilitates and receive public input, and act as an information resource concerning the CCMP.

The CMP Coordinator represents the City at meetings, conferences, and in ongoing interactions with applicants, the general public, and state and federal agency staff regarding the CMP.

7.4 GENERAL “COASTAL CONSISTENCY” INFORMATION

7.4.1 Subject Uses

In accordance with 11 AAC 100.010, land and water uses and activities in the District that are subject to a consistency review and District enforceable policies include the following:

- Federal activities affecting coastal uses or resources,
- Land and water uses and activities requiring federal permits or authorizations (see 11 AAC 110.400), and
- Land and water uses and activities requiring state permits or authorizations.

In addition, outside of the state consistency review process, there may be a local consistency review for land and water uses in the District for land and water uses and activities requiring local permits or authorizations.

7.4.2 Proper and Improper Uses

Under 11 AAC 114.260, District CMPs are required to identify uses and activities, including uses of state concern, that are considered proper and improper within the District. The City has not identified any uses that are categorically prohibited within the District. Proper and improper uses are determined by their compliance with performance standard policy requirements.

All land or water uses or activities within the City are considered to be proper, as long as they comply with the policies of this CMP, the ACMP standards under 11 AAC 112, and applicable federal and state regulations. All other land or water uses or activities are considered to be improper if they are inconsistent with ACMP standards, the policies of this CMP, or if they do not comply with or cannot be made to comply with applicable federal and state regulations. Designated areas included in this CMP identify specific land or water uses and activities that will be allowed or not allowed.

7.4.3 Designated Use Areas

District policies related to: natural hazards; energy facilities; subsistence; historic, prehistoric and archeological resources; recreation; tourism; commercial fishing and seafood processing; and habitat apply to projects within designated use areas identified in this CMP.

7.4.4 Uses of State Concern

Uses of state concern are uses and activities that are considered to be of state or national interest. A district cannot restrict or excluded uses of state concern unless they provide ample justification for the exclusion or restriction within the district plan.

AS 46.40.210(12) defines uses of state concern. In addition, the former Coastal Policy Council issued Resolution Number 13 that specifies more categories and criteria for uses of state concern. This resolution remains in effect until it is superseded by statutes or regulations, or until it is formally rescinded by ADNR.

7.5 COASTAL CONSISTENCY REVIEWS

Because the State of Alaska has adopted this CMP as an amendment to the ACMP, the City is one of several reviewers that concurs or objects to an applicant's consistency certification or a federal agency's consistency determination to the coordinating agency during consistency review. Based on these comments and on the policies and procedures of the ACMP, the coordinating agency issues a consistency finding.

7.5.1 Two Types of Consistency Reviews

The enforceable components in this CMP form the basis for a determination of consistency with the CMP. There are two types of reviews: state-coordinated consistency reviews and locally coordinated consistency reviews. When a project is proposed, State ACMP project reviewers determine which authorizations are needed. If the project is a federal activity, or needs state or federal authorization, the State of Alaska reviews the project for consistency with the ACMP. The City also participates in the state-coordinated review. If only local authorization is required (but not state or federal authorization), then the City itself reviews the project for consistency with the ACMP.

7.5.2 Determination of Consistency in Connection with Other Permits and Approvals

In addition to consistency, an applicant is required to obtain all other necessary permits and approvals required in connection with a proposed project. A determination of consistency does not guarantee or presume approval of any other federal, state, or local permit.

7.5.3 ADEC "Carve Out"

ADEC's air, land, and water quality standards are the exclusive standards of the ACMP for those purposes. Issuance of ADEC permits, certification, approvals, and authorizations establishes consistency with the ACMP for those activities of a proposed project subject to those permits, certifications, approvals, or authorizations. A project that includes an activity subject to ADEC authorization on the C List (see ABC List below) may be subject to a coordinated review if the project includes a different activity that is not subject to ADEC authorization, but is the subject of an enforceable District policy or another C-listed authorization. However, the specific activities subject to the ADEC authorization are not within the scope of those project activities to be reviewed.

In the case of an ADEC single agency review, the scope of review is limited to an activity that is the subject of a district enforceable policy. ADEC Policy Guidance No. 2003-001, January 7, 2004, contains the actual procedure by which ADEC will participate and coordinate in ACMP consistency reviews. This document is titled: *ADEC Single Agency Coastal Management Consistency Review Procedures and sets forth the Uniform Procedures for Conducting a Coastal Management Consistency Review for Projects that Only Require a [DEC] Permit or Contingency Plan Approval to Operate.*

7.5.4 "ABC" List

The ABC List is a classification system of state and federal approvals that can streamline the consistency review portion of the state permitting process for a proposed project. The intent of the ABC List (specifically the "A" and "B" portions of the List) is to reduce the amount of time reviewers must spend on reviewing routine individual projects, allowing them to concentrate on more complex projects that require a more involved ACMP consistency review.

The ABC List actually breaks down into three lists:

- The "A" List represents categorically consistent determinations – approvals of activities requiring a resource agency authorization, when such activities have been determined to have minimal impact on coastal uses or resources.
- The "B" List has been broken into two sections.
Section I – represents generally consistent determinations – approvals for routine activities that require resource agency authorization(s), when such activities can be made consistent with the ACMP through the application of standard measures.
Section II – includes nationwide permits and general permits that have been found to be consistent with the ACMP.
- The "C" List represents a comprehensive listing of those state permits that may trigger consistency review.

Projects do not always fit neatly into just one of the three ABC Lists. Some projects need authorizations that fall under more than one list, or include activities that are not found in the “B” List. For these projects, OPMP will determine how much review the project requires.

7.6 FEDERAL AUTHORITY AND CONSISTENCY DETERMINATION

In accordance with federal law, the District excludes all federal lands and waters within its boundaries. Federal lands and waters are those lands and waters managed, owned, or held in trust by the federal government.

However, the federal government is not exempt from the ACMP or the CMP. Federal law requires "federal agencies, whenever legally permissible, to consider State management programs as supplemental requirements to be adhered to in addition to existing agency mandates." Per 15 CFR 930.32(a). The federal government meets this requirement in several ways, depending upon the type of project or activity being considered.

First, federally licensed or permitted activities proposed within the District and affecting coastal uses or resources must be **consistent** with the ACMP, including the CMP (15 CFR 930.50).

Second, federal licensed and permitted activities described in detail in Outer Continental Shelf plans and affecting coastal uses or resources must be **consistent** with the ACMP, including the CMP (15 CFR 930.70).

And finally, all **federally conducted or supported activities**, including **development projects** directly affecting the District, must be **consistent to the maximum extent practicable** with the ACMP, including the CMP. Federal activities are "any functions performed by or on behalf of a federal agency in the exercise of its statutory responsibilities." This does not include the issuance of a federal license or permit. Federal development projects are those federal activities "involving the construction, modification, or removal of public works, facilities, or other structures, and the acquisition, utilization, or disposal of land or water resources" per 15 CFR 931.31. The phrase "consistent to the maximum extent practicable" means that such activities and projects must be "fully consistent with such programs unless compliance is prohibited based upon the requirements of existing law applicable to the federal agency's operations" per 15 CFR 930.32(a).

7.7 CITY PARTICIPATION IN STATE-COORDINATED CONSISTENCY REVIEW

7.7.1 Procedures

The point of contact for state and federal consistency reviews involving the City CMP is the OPMP. OPMP addresses are:

Southcentral Regional Office	Central Office
550 W 7th Avenue, Suite 1660	302 Gold Street, Suite 202
Anchorage, Alaska 99501	Juneau, Alaska 99801-0030
Phone: (907) 269-7470	Phone: (907) 465-3562
Fax: (907) 269-3981	Fax: (907) 465-3075

The state-coordinated consistency review process is contained in state regulations at 11 AAC 110. The City may participate in that process as an affected coastal district. A brief discussion of the City's role in the state consistency review process is described in this section. However, applicants should obtain current information on the state consistency review process from OPMP.

The City strongly recommends that applicants who seek state or federal permits for a major or complex project in the District request pre-review assistance prior to submitting such an application. The City seeks to work with applicants to initiate early communication and facilitate an expedient and informed consistency review.

The coordinating agency will notify the City of a pending consistency review. If requested, the City will participate in determining scope of review of a proposed project, based on the City's enforceable policies.

Upon the notification from the coordinating agency of the start of a consistency review, the CMP Coordinator will determine whether the project information is adequate to allow the City to concur or object to an applicant's consistency certification. If more information is required, the City will notify the coordinating agency by the "request for additional information" deadline and specifically identify the additional information required.

7.7.2 Permit Application Meeting

During a consistency review, the CMP Coordinator may contact the coordinating agency to request a meeting to resolve issues. The purpose of the meeting is to discuss the coastal management and permitting issues of the proposed activity and to work toward resolution of Issues of Local Concern and potential conflicts. This meeting should be scheduled no later than 10 days after the CMP Coordinator receives notification of the action. At a minimum, representatives of the coordinating agency, the City, affected villages, affected major landowners, the applicant, affected interest groups and organizations, and affected resource agencies will be invited to participate. Depending on the nature of the activity and travel constraints, the meeting may involve a meeting or teleconference. Subsequent work sessions may be beneficial to reaching early consensus on the consistency determination. Scheduling a permit application meeting does not change the final consistency review deadline of 90 days as directed in 11 AAC 100.265.

7.7.3 Consistency Comments

During the period allowed to review and consider the proposed use, the City will prepare written comments on the applicant's consistency certification. In preparing a consistency review comment, the

City will comment on consistency with state standards. In order to be considered by the coordinating agency, City comments must be in writing and must:

- State that the City concurs with the applicant's consistency certification and explain why, or
- Identify that the City objects to the applicant's consistency certification.

If the City objects, then it must:

- Identify and explain why the proposed project is inconsistent with specific state standards or District enforceable policies; and
- Identify any alternative measure that, if adopted by the applicant, would achieve consistency with the specific state standard or District enforceable policy.

Alternative measures are project conditions proposed by a state resource agency or District that, if adopted by the applicant, would make the project consistent with either state standards or District enforceable policies. If the City proposes alternative measures, they must explain how the alternative measure would achieve consistency with the specific enforceable policies in question.

When the consistency review is routine in nature and the Planning Commission does not need to take action, the CMP Coordinator will issue the City's consistency comments on behalf of the Planning Commission.

Upon receiving notice of local, state, or federal permit application, the CMP Coordinator will notify the mayor/city manager of any cities or villages, the president of any Indian Reorganization Act Councils or Traditional Councils, and the appropriate Native regional non-profit corporation that could potentially be affected by the proposed action. The CMP Coordinator will also determine if major landowners will be affected by the proposed action, and will contact their representatives to identify concerns and special conditions for development.

The CMP Coordinator will ensure that local concerns are solicited and appropriately incorporated in the City's consistency comment. One or more representatives of any villages affected by the proposed use may assist the CMP Coordinator in preparing the comments. Input from appropriate Native corporation land managers may also be solicited. The City or village representative is responsible for providing information on local community concerns and input about the proposed development. Local input to the City consistency comment must be received promptly in order to meet the state review deadlines. The City will consider such input in developing comments and alternative measures regarding the consistency of a proposed project. Where local concerns cannot be incorporated in the City consistency comment, the CMP Coordinator must provide justification for this decision to the local contacts involved.

7.7.4 Public Hearing During a State-coordinated Consistency Review

Any person or affected party may request that the coordinating agency hold a public hearing on a project or activity undergoing a consistency determination by providing adequate justification for the request as specified in 11 AAC 110. During the initial consistency review, the CMP Coordinator, in consultation with the Planning Commission and affected parties, may decide that the scope of a project will require a public hearing. If a public hearing is needed, the CMP Coordinator will submit a written request to the coordinating agency that a public hearing be held and outline the need for such a hearing. The coordinating agency will review the request to determine if it is based on concerns not already adequately addressed in the review. If a public hearing is held, the 90-day deadline in 11 AAC 110.265 for the

completing the consistency review is unchanged. The coordinating agency should be consulted for the exact schedule.

7.7.5 Changes in the Nature of a Permitted or Approved Activity

Per 11 AAC 110.280, an applicant that proposes a modification to an activity for which a final consistency has been issued must submit a new coastal project questionnaire to the agency that coordinated the consistency review. The modification is subject to another consistency review if the modification will have significantly different effects than the existing use on the resources of the District, and if a new authorization or change in authorization is required.

7.7.6 Due Deference

Due deference is a concept and practice within the consistency review process that affords the commenting review participants the opportunity to include, review, or refine the alternative measures or consistency concurrence if they have expertise in the resource, or the responsibility for managing the resource. The City and resource agencies are provided deference in interpreting policies and standards in their area of expertise or area of responsibility. First, in order to be afforded due deference, the district must have an approved CMP and have commented during the consistency review. Then the district may be afforded due deference if no resource agency has specific authority or expertise, and if the district can demonstrate expertise in the field.

A district does not have to have a specific policy that applies to the proposed project under review. The district may comment on the consistency of the proposed project within the state standards.

If the coordinating agency rejects the comments of the City, or any alternative measures that the City might seek to have imposed on the application in connection with a consistency determination, the coordinating agency must provide a brief written explanation stating the reasons for rejecting or modifying the alternative measure. *Note: this requirement only applies when the coordinating agency disagrees with the City on issues involving the interpretation and application of the CMP.*

Under the provisions of AS 46.40.100, actions and approvals by local governments are also subject to consistency with approved district coastal management plans. In some cases, a proposed action requiring a municipal permit or approval will also need a state or federal permit, and the federal/state consistency review will take place at the state level. Sometimes, a proposed action will only require a municipal permit and no state or federal permit. In such cases, the municipal government is responsible for reaching the consistency determination.

7.7.7 Uses Subject to Local Consistency Review

All uses that are proposed in the District that do not require federal or state authorization, or that is not a federal activity, will require a determination of consistency from the City if they are among the following local subject uses:

- All land and water uses requiring a permit or approval in accordance with City Code 18.110, or
- All land and water uses requiring a permit or approval in accordance with the City of Cordova Code zoning 15.150.

City procedures for local consistency determinations are simple and are designed to quickly determine whether a proposed use is consistent with the CMP.

7.7.8 Application Procedure and Time Line

There is no separate application for a local consistency determination under the CMP. Rather, the applicant desiring to undertake a subject use applies to the City depending on where the use is to be located) for the required land use permit or approval. When an application involves land within the District, but outside of the City, the land use permit application usually provides the City with the information required in order to make a consistency determination. When an application involves land within the City, the Planning Department will determine what information is required.

7.7.9 Local Consistency Determinations Outside the City of Cordova

The point of contact for local consistency reviews involving District lands outside the City is the CMP Coordinator, a staff position in the City Department of Planning. The address of the CMP Coordinator is:

City of Cordova
P.O. Box 1210
Cordova, Alaska 99574
Phone 907-424-6220
Fax 907-424-6000

The City will issue its consistency determination in conjunction with the underlying zoning permit or approval. The underlying permit or approval process will establish the time line for a local consistency determination. If the information provided by the applicant is incomplete or insufficient to allow a local consistency determination, the City will ask the applicant for the missing or required information in accordance with local authorization procedures.

The City zoning ordinance details the review process and schedule for each specific permit or approval required. The City will conduct its consistency review concurrently with its zoning permit or approval review process. Upon issuing its zoning permit or approval, the City will also issue a consistency determination.

The City strongly recommends that applicants who seek authorization from the City for a major project requiring local consistency review request a pre-application meeting before submitting the application.

7.7.10 Local Consistency Determinations Inside the City of Cordova

Subject uses within the City that do not require a state or federal authorization, or that are not a federal activity, will have a local consistency determination made by the City. The uses listed as permitted for each zoning district within the City, under the City's zoning ordinance, shall be deemed to meet the Cordova Land Use Area policy requirements for subject uses that do not require a state or federal permit. Rezoning, conditional uses, and new subdivisions are actions that require local consistency determinations by the City, based on the policies of the Cordova Land Use Area.

Reviewing certain actions for coastal consistency under a municipal zoning and subdivision ordinance does not make these land use controls part of the City plan and subject to state review and approval. Therefore, amendments to the local zoning and subdivision ordinances will not require an amendment to the approved CCMP; however, the local zoning and subdivision ordinances may not conflict with the CCMP.

The City strongly recommends that applicants who seek authorization from the City for a major project requiring local consistency review request a pre-application meeting before submitting the application.

7.8 ELEVATION PROCESS AND APPEALS

7.8.1 Elevation of State Consistency Determination

An elevation of a consistency determination issued by a coordinating agency shall follow the procedures established under regulations at 11 AAC 110.600.

7.8.2 Appeal of Local Consistency Determination Outside the City

The applicant, or any aggrieved person, may appeal the City's consistency determination to the Planning Commission or Council, in accordance with the procedures established for the appeal of the underlying zoning permit or approval in the City zoning ordinance. Subsequent appeals may be made to the Superior Court in accordance with the procedures established in the City zoning ordinance.

7.8.3 Appeal of Local Consistency Determination Inside the City

The applicant, or an aggrieved party, may appeal the City's consistency determination in accordance with the procedures established in the City's zoning ordinance for the appeal of the underlying permit or approval.

7.9 PLANNING FOR MAJOR PROJECTS

7.9.1 Introduction

Certain types of activities can significantly impact coastal resources and create major changes within the District. The City is interested in participating in agency planning for large-scale development projects and land management decisions. A consistency determination for a major project often takes place after the planning process is completed, which may mean that substantive decisions concerning the use have already been made. Conflicts that could have been avoided by mutual agreement early on become costly in terms of time and effort spent on resolving differences later on. To avoid this, major project planning establishes the following objectives:

- City CMP policies should be considered as early as possible in planning for proposed major uses.
- Problems and potential consistency conflicts should be addressed and resolved prior to the application stage.
- Prior resolution of differences should speed the issuance of subsequent permits or approvals.

There are three procedures that are strongly encouraged for major activities of area-wide concern: 1) pre-application meetings, 2) permit application meetings, and 3) local partnership in planning activities. Participation in these procedures has the following objectives:

- Apply coastal management policies early in project or plan development.
- Address problems and potential consistency evaluation conflicts prior to the permit or approval stage.
- Speed up subsequent permits or approvals through early resolution of issues.
- Ensure the compatibility of future planning projects with the approved CMP.

7.9.2 Major Projects

The following types of activities and actions are considered to be major activities of regional concern:

- Oil and gas exploration, development, and support activities;
- Land disposal and subdivision of land over 100 acres in size;
- Transportation/utility facility and corridor designation or construction;
- Mineral exploration or development (projects requiring development of a new airstrip or roads, major energy generation or transmission facilities, slurry pipelines, port facilities, extensive overburden or tailings disposal areas, offshore mining, or significant stream diversion);
- Large scale sand, rock, and gravel extraction activities (greater than 25,000 cubic yards);
- Transportation, storage, cleanup, and disposal of hazardous substances (including the Defense Environmental Restoration Act Program and other federal sites);
- Development of management guidelines for subject uses and activities on National Wildlife Refuges, National Parks and Preserves, and State of Alaska Critical Habitat Areas;
- Development of management guidelines for subject uses and activities on Native Corporation lands;
- Industrial projects, including fish processing and petroleum product storage and transfer; and
- Construction or major additions to military facilities within the City.

7.9.3 Local Participation in Planning Activities

Local participation in state and federal planning activities that affect the allocation of resources in the District benefits everyone involved. State and federal agencies should invite representatives of the Planning Commission, District communities, and major District landowners and land managers to take part when conducting regional planning and resource allocation studies. The Planning Commission will assist in identifying local representatives who are capable of ensuring that the plans that are developed accurately reflect local concerns and have credibility both in the City and state governments.

7.9.4 Pre-application Meeting Between the City and Applicant

At least 60 days prior to filing a permit application for a federal, state, or local permit or approval, or proposing action on a disposal or management plan, parties involved in activities on the "major project" list are strongly encouraged to present a plan for activities to the Planning Commission and other participants in the consistency review process. This meeting is not part of a state-coordinated consistency review and is optional.

Developers of large industrial projects allow for sufficient lead-time between their plan presentation to the Planning Commission and filing the permit application, so that key issues can be addressed in the project planning and permit applications submitted. It is recommended that the prospective applicant submit to the City, in any format desired, the following information clearly and in sufficient detail:

- **Project Description.** The description should consist of a narrative describing the proposed use or activity.
- **Site Description.** The description should include information about the property as it currently

exists, including such items as size, existing structures, vegetation, topography, and any other features that may be a factor in the design of or operation of the proposed project.

- **Owner, Sponsor, or Developer.** The name of the agency, activity, business enterprise, or person who will own the use should be provided, along with the name of other operators, if any.
- **Location and Size.** The location and size of the proposed project should be identified. A map, prepared at the most appropriate scale, and which may initially be hand drawn, should be provided showing the location of the proposed use and any structures, roads, or alterations planned for the area. As the significance or complexity of the proposed project increases, the City may, at its discretion, determine that professionally prepared maps and other documentation are needed at the time of application.
- **Construction Schedule.** The dates of any construction or other preparatory site activity should be given.
- **Operation Schedule.** The dates, times, and, if applicable, seasons of operation should be given.
- **Special circumstances.** Any special circumstances that exist that affect decisions made should be described.
- **Impact Assessment.** The prospective applicant's assessment of the impact on District resources that will be created by the proposed use should be given.
- **Statement of Consistency.** The applicant should provide a sufficiently detailed statement demonstrating that he/she has assessed the project against applicable CMP policies, and believes that the proposed use is consistent with the CMP. Supporting material, such as studies and assessments supporting the prospective applicant's assertions, should be submitted to support any area where compliance is not apparent. Written justification for deviating from any applicable CMP policy should be provided in the event that the proposed use does not comply with one or more of the pertinent policies.
- **Mitigation Measures.** Any actions or measures that will be undertaken to bring a nonconforming proposed use into conformity with the policies of the CMP should be explained.

The City recommends that the applicant provide the following additional information in connection with proposed uses that are of large size, occupy a large land area, involve intensive activities, or are generally complex in nature:

- **Statement of Local, State, or Federal Need.** Information supporting the public need and necessity for, and the benefit to be gained from, the project.
- **Alternative Sites.** Consideration of alternative locations outside the District.
- **Alternative Size and Scope.** Consideration of a reduced size and/or scope of the project.
- **Alternative Development Schedule.** Consideration of alternative construction and site preparation times.

Within 30 days of notification that an applicant would like to make a presentation, the CMP Coordinator will notify affected villages, major landowners, the general public, and other consistency review participants, and will work with these groups to hold the presentation meeting. As appropriate, discussions may follow the presentation to identify issues and conflicts that need to be addressed prior to permit review and preparation of the City consistency comment. The CMP Coordinator and Planning Commission will be available to work with developers in project planning. The CMP Coordinator may provide a written summary to the developer outlining major consistency concerns and policy issues.

Copies will be sent to OPMP and the coordinating agency. All pre-application meetings sponsored by the City are open to the public, and public notice of the meeting will be provided. The City will notify appropriate state agencies in advance and invite them to attend.

After the applicant's presentation, discussions will be held to identify issues and conflicts that need to be addressed prior to the submission of a formal application. Following the meeting, the City will undertake additional pre-application work with the prospective applicant in project planning on request.

7.10 AMENDMENTS AND REVISIONS

[NOTE: AS 11 AAC 365(b) REQUIRES THAT THE DISTRICT REVIEW AND SUBMIT THEIR PLAN TO ADNOR EVERY 10 YEARS FOR REAPPROVAL. DISTRICTS MAY SPECIFY A SHORTER TIME FRAME TO REVIEW THEIR PLANS.]

Every five years, the CMP Coordinator should initiate a local review of the approved coastal plan. This formal review gives residents, developers, affected communities, and local landowners an opportunity to become familiar with the CMP and its policies, and to propose amendments. Changes can keep the CMP up to date and relevant. Some adjustments may be made to coastal zone boundaries or land use districts based on new information. Policies may be further refined and standards adopted to facilitate the consistency review process. More detailed plans developed for special areas, such as the AMSA, may be incorporated into the CMP after state and federal approval.

In addition, after completing any regional planning efforts, the Planning Commission may evaluate amending the CMP to include pertinent policies, classifications, and resource data developed through the specific planning process. The City Council must approve all amendments to the CMP. The Commissioner of ADNOR and the federal Office of Ocean and Coastal Resource Management must also approve any amendment to the CMP. The process for amending the CMP is provided in regulations at 11 AAC 114.

Two processes are available to the City for amending its CMP. The minor amendment process quickly incorporates minor changes. The significant amendment process provides a more thorough review for important changes. Examples of changes that are a significant amendment to the CMP are:

- New policies or changes to existing policies,
- Alteration to the coastal zone boundaries,
- AMSAs or ACMP special management areas, or
- Restrictions or exclusions of a use of state concern not previously restricted or excluded.

7.11 MONITORING AND ENFORCEMENT

AS 46.40.100 gives state resource agencies and municipalities enforcement responsibility for provisions of the ACMP. If an applicant fails to implement an adopted alternative measure, or if the applicant undertakes a project modification not incorporated into the final determination and not reviewed under 11 AAC 110.800- 820, it is a violation of the ACMP. The responsibility for enforcing alternative measures carried on state and federal permits rests with the permitting agency. The City strongly encourages the state to enforce alternative measures and bring violators into compliance.

District policies and ACMP standards are implemented at the state level through alternative measures incorporated into the project description. The ACMP does not issue a separate coastal permit, but relies

on existing state authorities. Thus, state monitoring and enforcement of the ACMP occurs primarily through agency monitoring and enforcement of alternative measures on their permits. A district can assist in this process by monitoring projects and providing information to appropriate state agencies.

The CMP Coordinator and the Planning Commission have first-hand knowledge of local concerns and issues related to development activities. The CMP Coordinator and Planning Commission may, within legal and logistical constraints, assist agencies and municipalities in their monitoring and compliance efforts. The intent is to ensure that alternative measures associated with the CMP are carried out in the development process.

The CMP Coordinator is the key individual in monitoring projects to ensure that alternative measures are carried out in the development process. The CMP Coordinator and Planning Commission will rely on community input in monitoring implementation of alternative measures. Individuals, local governments, and landowners in the District may report suspected violations to the CMP Coordinator, Planning Commission, or state and federal resource agencies. The CMP Coordinator will investigate reports of violations and follow up with appropriate action to ensure state or federal enforcement. The CMP Coordinator and Planning Commission will work with state and federal agencies in monitoring and enforcement, and provide responsible agencies with copies of local reports on noncompliance. This will include adherence to permit conditions, cooperative plans, and the policies of the CMP.

If a subject use requires a zoning permit or approval from the City, the City will carry on its zoning permit all conditions placed on the subject use in the consistency determination. The City will do the same for subject uses requiring a zoning permit or approval from the City. In such instances, the permitting state and/or federal agency will share concurrent jurisdiction with the City, and either or both may seek to enforce the conditions placed on the subject use.

7.12 PUBLIC EDUCATION AND OUTREACH

The City CMP is committed to understanding how coastal management can benefit communities and residents within City boundaries, and knows the most important way to gain this understanding is to listen to people. This local coastal professional also knows if coastal management is presented within the framework of local issues, concerns, and visions for the future, residents will be more likely to participate and support the plan.

The District Coordinator already has a general feel for local issues and sentiment, and should encourage decision-making bodies and residents of the City to use coastal management as a way to identify areas appropriate for development, keep coastal resources healthy, and as a way to affect state and federal decision-making. The CMP Coordinator also wants to ensure that local knowledge and public needs are heard and considered when local coastal resources and way of life might be affected by a development proposal. Some other education and outreach opportunities that the CMP Coordinator might consider as he/she identifies how best to communicate about coastal management within the City includes:

- Request general ACMP publications from OPMP and make sure these are available to local residents. The CMP Coordinator can apply labels with local contact information to each of these publications before putting them out in the City office reception areas and his/her office.
- Use public service announcements (radio and newspaper), flyers, newspaper ads, and phone calls to encourage the input from residents during the review of projects.
- Encourage local residents to communicate with the CMP Coordinator about coastal issues.

- Talk to legislators about how the ACMP benefits the people, local coastal resources, and the local economy.
- Provide local news and volunteer to write articles for the ACMP website.
- Develop a City coastal management web site and provide a link to the ACMP website. Once this website is regularly providing information considered important by locals, the CMP Coordinator can develop a promotional strategy for getting the word out about this valuable information source.
- Train local teachers or other environmental educators about ACMP-related materials, including the “Discover the Zone” game for kids.
- Be available for work in the schools, especially during Sea Week in the spring.
- Volunteer to serve as a mentor to high school students, especially if a local high school is participating in the annual National Ocean Sciences Bowl quiz game and research paper hosted at the Alaska SeaLife Center in Seward.
- Develop a presentation on the CCMP and the ACMP and pursue speaking engagements with different community organizations. The CMP Coordinator can request assistance from OPMP to develop and, if appropriate, deliver this presentation.
- Participate in state, federal, and tribal natural resource planning efforts.
- Participate in watershed volunteer efforts and help them seek sources of funding.
- Encourage City Council and Planning Commission members to participate in education and outreach efforts, and provide them with the resources they will need to do this.
- Organize and participate in an annual beach clean up. If appropriate, coordinate this local effort with the international beach clean up held every year in September.
- Use OPMP as a resource.

APPENDIX A
Enforceable Policies

APPENDIX A

ENFORCEABLE POLICIES

1.1 INTRODUCTION

The policies presented in this chapter are the "rules" of the CCMP. All land and water uses and activities occurring on state and private lands, and federally-permitted activities which affect coastal resources within the Cordova coastal boundary are subject to the policies of the CCMP. Uses and activities must comply with applicable coastal management policies to be considered "consistent" with the District's CMP. These policies are the standards used by all parties participating in the consistency determination process during review of state and federal permit applications (see Chapter 7).

1.2 ADEQUACY OF EXISTING STATE AND FEDERAL LAWS

Under State statutes, the enforceable policies of the District CMP must:

- Be clear and concise as to the activities and persons affected by the policies, and the requirements of the policies;
- Use precise, prescriptive, and enforceable language; and
- Not address a matter regulated or authorized by state or federal law unless the enforceable policies relate specifically to a matter of local concern.

A matter of local concern is a specific coastal use or resource within a defined portion of the District that is:

- Demonstrated as sensitive to development,
- Not adequately addressed by state or federal law, and
- Of unique concern to the District as demonstrated by local usage or scientific evidence.

Under state regulations, District enforceable policies that address matters included in the statewide standards must be a matter of local concern in order to be approved. In regard to the second prong of the test, a specific coastal use or resource is not adequately addressed by state or federal law when: (1) the laws are broad in scope and general in their application and more specificity is needed to address local issues; or (2) a local issue or management goal related to the categories of uses, activities, or areas identified in the statewide standards and designations is not addressed by state or federal law.

In the sections that follow, adequacy is discussed for each matter that is addressed by the Cordova enforceable policies in this chapter.

1.3 COASTAL DEVELOPMENT STANDARD

11 AAC 112.200. Coastal development.

(a) In planning for and approving development in or adjacent to coastal waters, districts and state agencies shall manage coastal land and water uses in such a manner that those uses that are economically or physically dependent on a coastal location are given higher priority when compared to uses that do not economically or physically require a coastal location.

(b) Districts and state agencies shall give, in the following order, priority to:

(1) water-dependent uses and activities;

(2) water-related uses and activities; and

(3) uses and activities that are neither water-dependent nor water-related for which there is no practicable inland alternative to meet the public need for the use or activity.

(c) The placement of structures and the discharge of dredged or fill material into coastal water must, at a minimum, comply with the standards contained in 33 C.F.R. Parts 320 - 323, revised as of July 1, 2003. (Eff. 7/1/2004, Register 170)

1.3.1 Coastal Development Applicability

Enforceable policies apply to development in or adjacent to coastal waters throughout the entire coastal resource district and to shorelines within the Eyak Lake AMSA, which has been designated for recreation and tourism use (see “Coastal Water” Appendix D, Definitions).

1.3.2 Coastal Development Adequacy

Prioritization of Uses

The statewide coastal development standard directs coastal districts to prioritize uses and activities in the coastal area based on whether the uses are water dependent, water-related, or neither – but without an inland alternative. These terms are broad in scope and an enforceable policy that defines which uses or activities in the district fall into each of the three categories is making the broad standard more specific.

Placement of Structures and Discharge of Dredged or Fill Material

The coastal development standard requires compliance “at a minimum” with U.S. Army Corps of Engineers (Corps regulations at, 33 Code of Federal Regulations Parts 320 to 323. These regulations provide the Corps with general permitting authority over the placement of structures and discharge of dredged or fill material into navigable waters; the laws are broad in scope and general in their application. The enforceable policies that relate to this standard provide more specificity to ensure that local issues are addressed.

1.3.3 Coastal Development Enforceable Policies

CD-1. Prioritization of Waterfront Land Use

In accordance with the prioritization requirement set forth in 11 AAC 112.200(b), the following shall be applied to coastal waters and within the AMSA:

- A. The following non-exhaustive list of land and water uses and activities are considered “water dependent.” Such uses are economically or physically dependent upon a coastal location, and as such are given a higher priority than those land and water uses and activities that are not water-dependent:

fish hatcheries; mariculture activities; fish processing; float plane bases; boat harbors; freight, fuel, or other docks; marine-based tourism facilities; boat repair, haul outs, marine ways, and accessory attached housing; remote recreational cabins dependent on water access; and facilities that serve as inter-modal transportation links for the transfer of goods and services between the marine transportation system and the road system.

B. The following non-exhaustive list of uses and activities are considered “water-related,” and thus given a lower priority of use than those previously listed as “water-dependent”: marine retail stores and commercial activities such as hotels, restaurants, and other similar uses that provide views and access to the waterfront.

C. Uses and activities which are neither water dependent nor water-related, but for which there is no practicable inland alternative to meet the public need for the use or activity, receive the lowest priority. Such uses and activities shall be permitted when it is not practicable to develop a site with a water-dependant or water-related use or activity due to shallow bathymetry or unusual lot characteristics such as substandard size, frontage, or steep topography, or when such uses would be inconsistent with zoning.

CD-2. Placement of Structures and Fill in Coastal Waters

A. Piling-supported or floating structures shall be used for construction in coastal waters and lakeshores within the AMSA, unless clear and convincing evidence shows that all of the following conditions exist:

1. There is a documented public need for the proposed activity;
2. There are no practicable inland alternatives that would meet the public need and allow development away from the waterfront;
3. Denial of the fill would prevent the applicant from making a reasonable use of the property;
4. The fill is placed in a manner that minimizes impacts on adjacent uses, public access easements along the shoreline, and water views;
5. The fill is the minimum amount necessary to establish a reasonable use of the property; and
6. Development of the property would support a water dependent use.

B. Placement of piling-supported or floating structures in coastal waters shall be subject to the following standards:

1. Use of structures shall be consistent with the allowable uses on the adjacent uplands. Where multiple uses occur, allowable uses shall be determined by extending the property boundary seaward and perpendicular to the shoreline.
2. Structures shall not be treated with exteriorly applied creosote preservative coatings.

1.4 COASTAL ACCESS STANDARD

11 AAC 112.220. Coastal access. Districts and state agencies shall ensure that projects maintain and, where appropriate, increase public access to, from, and along coastal water. (Eff. 7/1/2004, Register 170)

1.4.1 Coastal Access Applicability

Enforceable policies apply to, from, and along coastal waters throughout the entire District and to, from, and along shorelines within the Eyak Lake AMSA, which has been designated for recreation and tourism use (see “*Coastal Water*” Appendix D).

1.4.2 Coastal Access Adequacy

The statewide coastal access standard is a very broad standard. The enforceable policies related to this standard provide more specific direction for providing appropriate public access to, from, and along coastal water. Alaska Department of Natural Resources (ADNR) access requirements are limited to ADNR tidelands or disposals of interest in state lands. No state or federal laws deal specifically with providing coastal public access irrespective of land ownership.

1.4.3 Coastal Access Enforceable Policies

CA-1. Maintenance of Public Access to Coastal Water

Proposed uses or activities shall not impede or degrade trails, viewsheds, beaches, boat launches, and other modes of access to coastal water and to shorelines within designated recreation and tourism use areas.

CA-2. Increased Public Access

Subdivision of State, University, Mental Health Trust, City, Eyak, and Chugach Corporation lands shall include public access to, from, and along coastal water and shorelines within designated recreation and tourism use areas.

CA-3. Enhanced Public Access

Capital Improvements on or adjacent to publicly-owned waterfront property shall incorporate walkways, shelters, and viewing platforms whenever practicable to increase public access to, from and along coastal waters and shorelines within designated recreation and tourism use areas.

1.5 RECREATION

Refer to the Eyak Lake AMSA, Chapter 6.

1.6 NATURAL HAZARDS STANDARD AND PLAN REQUIREMENTS

11 AAC 112.210. Natural hazard areas. (a) In addition to those identified in 11 AAC 112.990, the department, or a district in a district plan, may designate other natural processes or adverse conditions that present a threat to life or property in the coastal area as natural hazards. Such designations must provide the scientific basis for designating the natural process or adverse condition as a natural hazard in the coastal area, along with supporting scientific evidence for the designation.

(b) Areas likely to be affected by the occurrence of a natural hazard may be designated as natural hazard areas by a state agency or, under 11 AAC 114.250(b), by a district.

(c) Development in a natural hazard area may not be found consistent unless the applicant has taken appropriate measures in the siting, design, construction, and operation of the proposed activity to protect public safety, services, and the environment from potential damage caused by known natural hazards.

(d) For purposes of (c) of this section, "appropriate measures in the siting, design, construction, and operation of the proposed activity" means those measures that, in the judgment of the coordinating agency, in consultation with the department's division of geological and geophysical surveys, the Department of Community and Economic Development as state coordinating agency for the National Flood Insurance Program under 44 C.F.R. 60.25, and other local and state agencies with expertise,

(1) satisfy relevant codes and safety standards; or

(2) in the absence of such codes and standards;

(A) the project plans are approved by an engineer who is registered in the state and has engineering experience concerning the specific natural hazard; or

(B) the level of risk presented by the design of the project is low and appropriately addressed by the project plans. (Eff. 7/1/2004, Register 170)

11 AAC 114.250. Subject uses, activities, and designations. (b) A district shall consider the likelihood of occurrence of natural hazards in the coastal area and may designate natural hazard areas. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

1.6.1 Natural Hazards Applicability and Designations

The applicability of enforceable policies is limited to natural hazard areas designated by the district under 11 AAC 114.250(b) (Volume II, Maps).

1.6.2 Natural Hazards Adequacy

The natural hazards statewide standard provides general appropriate measures for the siting and operation of activities within designated areas. In addition, 11 AAC 114.270(g) allows districts to adopt enforceable policies that will be used to determine whether a use or activity will be allowed within a designated areas. Enforceable policies related to this standard provide specific measures to help minimize impacts within designated areas and to ensure that local issues are addressed. Policies also identify specific disallowed uses within designated areas and the criteria that will be used to determine whether a use will be allowed. Other state and federal laws that deal with development activities in floodplains and other hazard areas are broad in scope and general in their application.

1.6.3 Natural Hazards Enforceable Policies

NH-1. Appropriate Measures

In accordance with the “appropriate measures” requirement set forth in 11 AAC 112.210 (c) and (d), the applicant shall consult with the City to incorporate local knowledge to develop best management practices applicable to the specific conditions at the proposed development site.

1.7 SAND AND GRAVEL STANDARD

11 AAC 112.260. Sand and gravel extraction. Sand and gravel may be extracted from coastal waters, intertidal areas, barrier islands, and spits if there is no practicable alternative to coastal extraction that will meet the public need for the sand or gravel. (Eff. 7/1/2004, Register 170)

1.8 SAND AND GRAVEL APPLICABILITY

Enforceable policies apply to coastal waters, intertidal areas, barrier islands, spits, and practicable alternatives throughout the entire coastal resource district (See *Coastal Waters*, Appendix D Definitions).

1.8.1 Sand and Gravel Adequacy

The statewide sand and gravel extraction standard is a very broad standard. Enforceable policies related to this standard provide specificity for extraction activities. Other state or federal laws that deal with permitting of sand and gravel extraction are broad in scope or limited in application to specific state or federal lands.

1.8.2 Sand and Gravel Enforceable Policies

SG-1. Sequencing of Coastal Extraction and Practicable Alternatives

To the extent practicable, sources of sand, gravel, rock, and other construction materials shall be approved in the following sequence:

- A. Existing approved gravel pits or quarries operated in compliance with state and federal authorizations;
- B. Reuse of material from abandoned development area, unless reuse could cause more environmental damage than non-use;
- C. New upland sites;
- D. Beaches of low habitat values; and
- E. Streams that do not provide fish habitat.

SG-2. Instream Material Extraction

Extraction of sand and gravel from all stream floodplains shall be located and conducted to avoid changes to channel hydraulics and the potential for channel diversion through the extraction site.

SG-3. Best Management Practices for Anadromous Waters

In streams and their floodplains that provide habitat for anadromous fish, the following practices shall be incorporated into the siting, design, and operation of sand and gravel extraction activities:

- A. Clearing of riparian vegetation and disturbance of natural banks shall be minimized;
- B. To the extent practicable, sand and gravel extraction site configurations shall be shaped to blend with physical features and surroundings;
- C. Settling ponds shall be adequately diked or set back from active channels to avoid breaching by a 25-year frequency flood. Effective use of recycled water shall minimize water withdrawal and subsequent discharge of effluent to adjacent lands or waters; and
- D. Equipment storage and operation shall be conducted in a manner that does not release fuel and lubricants into the environment.

SG-4. Reclamation and Restoration

Reclamation of all upland and floodplain extraction sites shall be required unless such reclamation would cause greater adverse impact to the environment than leaving the area un-reclaimed. At a minimum, reclamation shall include the following elements, as applicable:

- A. Topsoil and overburden shall be segregated and stored separately above the 25-year floodplain of watercourses.
- B. At the end of each extraction season, all disturbed areas shall be regraded to stable slopes. Within mean annual floodplains, regrading to ground contours that will not entrap fish nor significantly alter stream hydraulics shall occur at the end of each operating season. Tailings used in the construction of settling ponds and other essential facilities may be retained in place until completion of their use.
- C. At the completion of extraction, all disturbed areas shall be stabilized and revegetated, as appropriate. Restoration shall include the following:
 - 1. All disturbed areas shall be graded to stable slopes that blend with the natural topography;
 - 2. Erosion control measures shall be implemented as appropriate to stabilize the site;
 - 3. Areas designated for revegetation shall be covered with topsoil to encourage establishment of native plant species; and
 - 4. Where material sites that are excavated below groundwater may have value as habitat for waterfowl or fish, the resource agencies shall be consulted on the final design and schedule of the restoration plan.

Excluded from these requirements is the portion of a gravel extraction site required to provide materials for continuing maintenance and operation. Maintenance sand and gravel sites shall comply with the requirements of part b) of this policy.

1.9 HISTORIC, PREHISTORIC, AND ARCHAEOLOGICAL RESOURCES STANDARD AND PLAN REQUIREMENTS

11 AAC 112.320. Historic, prehistoric, and archeological resources. (a) The department will designate areas of the coastal zone that are important to the study, understanding, or illustration of national, state, or local history or prehistory, including natural processes.

(b) A project within an area designated under (a) of this section shall comply with the applicable requirements of AS 41.35.010 – 41.35.240 and 11 AAC 16.010 – 11 AAC 16.900. (Eff. 7/1/2004, Register 170)

11 AAC 114.250. Subject uses, activities, and designations. (i) A district shall consider and may designate areas of the coast that are important to the study, understanding, or illustration of national, state, or local history or prehistory. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

1.9.1 Historic, Prehistoric, and Archaeological Resources Applicability and Designations

Cordova recognizes that the number of known, and potential, cultural, and historical resources are significant and can make a valuable contribution to understanding the past.

The applicability of enforceable policies is limited to those sites on the Alaska Heritage Resources Survey (ARHS) inventory of all reported historic and prehistoric sites within the State of Alaska, and to the District under 11 AAC 114.250(i). The ARHS inventory is maintained by the State Office of History and Archaeology. The ARHS inventory of cultural resources includes objects, structures, buildings, sites, districts, and travel ways, with a general provision that they are over 50 years old. To date over 22,000 sites have been reported within Alaska. For each individual site, the ARHS maintains a site record containing such information as the site name, a description of the physical remains, data on the site's location, and a list of bibliographic citations, as well as a variety of additional information relevant to management and research needs.

1.9.2 Historic, Prehistoric, and Archeological Adequacy

The historic, prehistoric, and archeologic resources standard provides general appropriate measures for the preservation and protection of such resources within designated areas. In addition, 11 AAC 114.250 allows districts to adopt enforceable policies that will be used to determine whether a use or activity will be allowed within the designated area. Enforceable policies related to this standard provide specific measures to help minimize impacts within designated areas and to ensure that local issues are addressed.

1.9.3 Historic, Prehistoric, and Archeological Enforceable Policies

HPA-1 Appropriate Measures

In accordance with the “appropriate measures” requirement set forth in 11 AAC 112.210 (c) and (d), the applicant shall consult with the City, Eyak Corporation, and Chugach Corporation, to incorporate local knowledge regarding the presence of historic, prehistoric, and archeological resources in the designated areas (see Section 5.9.1).

1.10 TRANSPORTATION AND UTILITIES STANDARDS

11 AAC 112.240. Utility routes and facilities. (a) *Utility routes and facilities must be sited inland from beaches and shorelines unless:*

- (1) the route or facility is water-dependent or water related; or*
- (2) no practicable inland alternative exists to meet the public need for the route or facility.*
- (b) Utility routes and facilities along the coast must avoid, minimize, or mitigate:*
 - (1) alterations in surface and ground water drainage patterns;*
 - (2) disruption in known or reasonably foreseeable wildlife transit;*
 - (3) blockage of existing or traditional access. (Eff. 7/1/2004, Register 170)*

11 AAC 112.280. Transportation routes and facilities. *Transportation routes and facilities must avoid, minimize, or mitigate:*

- (1) alterations in surface and ground water drainage patterns;*
- (2) disruption in known or reasonably foreseeable wildlife transit; and*
- (3) blockage of existing or traditional access. (Eff. 7/1/2004, Register 170)*

1.10.1 Transportation and Utilities Applicability

Enforceable policies apply throughout the entire District.

1.10.2 Transportation and Utilities Adequacy

The statewide transportation and utility routes and facilities standards are limited to addressing impacts to surface and groundwater drainage patterns, disruption in known or reasonably foreseeable wildlife transit, and blockage of existing or traditional access. Enforceable policies that relate to these standards provide more specific measures that address route and facilities local issues and concerns. Other state and federal laws that deal with the permitting of transportation and utility routes and facilities are broad in scope and general in their application.

1.10.3 Transportation and Utilities Enforceable Policies

TU-1 Visual Access

Where practicable, overhead lines shall be located in a manner that does not interfere with scenic coastal vistas.

TU-2 Corridor Consolidation and Integration

In accordance with the requirements set forth in 11 AAC 112.240, utility corridors shall, wherever practicable, be integrated with roads and other transportation corridors.

1.11 FISH AND SEAFOOD PROCESSING REQUIREMENTS

11 AAC 114.250. Subject uses, activities, and designations. (f) A district shall consider and may designate areas of the coast suitable for the location or development of facilities related to commercial fishing and seafood processing. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

1.11.1 Fish and Seafood Processing Applicability and Designations

The applicability of enforceable policies is limited to areas of the coast designated by the District under 11 AAC 114.250(f) as suitable for the location or development of facilities related to commercial fishing and seafood processing. Although Cordova recognizes that fish processing provides significant employment and income to local residents and business owners, no areas of the coast suitable for the location or development of facilities related to commercial fishing and seafood processing are designated due to inadequate resources to develop the designations.

1.12 HABITATS STANDARD AND PLAN REQUIREMENTS

11 AAC 112.300. Habitats. (b) The following standards apply to the management of the habitats identified in (a) of this section:

- (1) offshore areas must be managed to avoid, minimize, or mitigate significant adverse impacts to competing uses such as commercial, recreational, or subsistence fishing, to the extent that those uses are determined to be in competition with the proposed use;
- (2) estuaries must be managed to avoid, minimize, or mitigate significant adverse impacts to:
 - (A) adequate water flow and natural water circulation patterns; and
 - (B) competing uses such as commercial, recreational, or subsistence fishing, to the extent that those uses are determined to be in competition with the proposed use;
- (3) wetlands must be managed to avoid, minimize, or mitigate significant adverse impacts to water flow and natural drainage patterns;
- (4) tideflats must be managed to avoid, minimize, or mitigate significant adverse impacts to:
 - (A) water flow and natural drainage patterns; and
 - (B) competing uses such as commercial, recreational, or subsistence uses, to the extent that those uses are determined to be in competition with the proposed use;
- (5) rocky islands and sea cliffs must be managed to:
 - (A) avoid, minimize, or mitigate significant adverse impacts to habitat used by coastal species; and
 - (B) avoid the introduction of competing or destructive species and predators;

(6) barrier islands and lagoons must be managed to avoid, minimize, or mitigate significant adverse impacts:

(A) to flows of sediments and water;

(B) from the alteration or redirection of wave energy or marine currents that would lead to the filling in of lagoons or the erosion of barrier islands; and

(C) from activities that would decrease the use of barrier islands by coastal species, including polar bears and nesting birds;

(7) exposed high-energy coasts must be managed to avoid, minimize, or mitigate significant adverse impacts:

(A) to the mix and transport of sediments; and

(B) from redirection of transport processes and wave energy;

(8) rivers, streams, and lakes must be managed to avoid, minimize, or mitigate significant adverse impacts to:

(A) natural water flow;

(B) active floodplains; and

(C) natural vegetation within riparian management areas; and

(9) important habitat:

(A) designated under 11 AAC 114.250(h) must be managed for the special productivity of the habitat in accordance with district enforceable policies adopted under 11 AAC 114.270(g); or (B) identified under (c)(1)(B) or (C) of this section must be managed to avoid, minimize, or mitigate significant adverse impacts to the special productivity of the habitat.

(c) For purposes of this section,

(1) "important habitat" means habitats listed in (a)(1) – (8) of this section and other habitats in the coastal area that are

(A) designated under 11 AAC 114.250(h);

(B) identified by the department as a habitat

(i) the use of which has a direct and significant impact on coastal water; and

(ii) that is shown by written scientific evidence to be significantly more productive than adjacent habitat; or

(C) identified as state game refuges, state game sanctuaries, state range areas, or fish and game critical habitat areas under AS 16.20;

(2) "riparian management area" means the area along or around a waterbody within the following distances, measured from the outermost extent of the ordinary high water mark of the waterbody:

(A) for the braided portions of a river or stream, 500 feet on either side of the waterbody;

(B) for split channel portions of a river or stream, 200 feet on either side of the waterbody;

(C) for single channel portions of a river or stream, 100 feet on either side of the waterbody;

(D) for a lake, 100 feet of the waterbody. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

11 AAC 114.250. Subject uses, activities, and designations. (h) A district shall consider and may designate portions of habitat areas listed in 11 AAC 112.300(a)(1) – (8) and other habitats in the coastal area as important habitat if:

(1) the use of those designated portions have a direct and significant impact on coastal water; and
(2) the designated portions are shown by written scientific evidence to be significantly more productive than adjacent habitat. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

1.12.1 Habitats Applicability and Designations

The applicability of enforceable policies is limited to important habitat areas designated by the district under 11 AAC 114.250(h). Although Cordova recognizes that the viability of fisheries resources is dependent on healthy offshore and onshore habitats, no areas are designated due to inadequate resources to develop the necessary documentation to support the designations. It is also true that many of the most important habitats are outside the district boundary and could therefore not be designated.

1.13 TIMBER HARVESTING STANDARD

11 AAC 112.250. Timber harvest and processing. AS 41.17 (Forest Resources and Practices Act) and the regulations adopted under that chapter with respect to the harvest and processing of timber are incorporated into the program and constitute the components of the program with respect to those purposes. (Eff. 7/1/2004, Register 170)

1.13.1 Timber Harvesting Applicability

The Forest Resources and Practices Act is incorporated into the ACMP. A district may not write enforceable policies under this standard. Timber harvest and processing is not included within the subject uses that provide the basis for enforceable policies.

1.14 AIR LAND AND WATER QUALITY STANDARD

11 AAC 112.310. Air, land, and water quality. Notwithstanding any other provision of this chapter, the statutes and regulations of the Department of Environmental Conservation with respect to the protection of air, land, and water quality identified in AS 46.40.040(b) are incorporated into the program and, as administered by that department, constitute the exclusive components of the program with respect to those purposes. (Eff. 7/1/2004, Register 170)

1.14.1 Air Land and Water Quality Applicability

Coastal district plans cannot include any enforceable policies that address air, land or water quality. One of the major reforms of House Bill 191 was to effectuate the direct state implementation of the Alaska Department of Environmental Conservation's (ADEC's) air, land and water quality standards. House Bill 191 specifically provides that ADEC's air, land, and water quality standards are the exclusive standards of the ACMP for those purposes.

1.15 SUBSISTENCE STANDARD AND PLAN REQUIREMENTS

11 AAC 112.270. Subsistence. (a) A project within a subsistence use area designated under 11 AAC 114.250(g) must avoid or minimize impacts to subsistence uses of coastal resources.

(b) For a project within a subsistence use area designated under 11 AAC 114.250(g), the applicant shall submit an analysis or evaluation of reasonably foreseeable adverse impacts of the project on subsistence use as part of:

(1) a consistency review packet submitted under 11 AAC 110.215; and

(2) a consistency evaluation under 15 C.F.R. 930.39, 15 C.F.R. 930.58, or 15 C.F.R. 930.76.

(c) Repealed ___/___/2004. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

11 AAC 114.250. Subject uses, activities, and designations. (g) Except in nonsubsistence areas as identified under AS 16.05.258, a district may, after consultation with appropriate state agencies, federally recognized Indian tribes, Native corporations, and other appropriate persons or groups, designate areas in which a subsistence use is an important use of coastal resources and designate such areas. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

The applicability of enforceable policies and the State standard is limited to subsistence use areas designated by the district under 11 AAC 114.250(g). Although Cordova recognizes that subsistence use is an important use of the fish, game, and plant resources in the region, no areas are designated due to inadequate resources to conduct the required consultation. It is also true that many of the most valuable subsistence use areas are outside the District boundary and could therefore not be designated.

APPENDIX B
Enforceable Policy Cross Reference Table

APPENDIX B

ENFORCEABLE POLICIES CROSS REFERENCE TABLE CORDOVA CMP AND EYAK LAKE AMSA PLAN

Enforceable Policy Name & Number	Resource Inventory & Analysis	Issues, Goals, and Objectives	Maps
Coastal Development CD-1 Prioritization of Waterfront Land Use CD-2 Placement of Structures and Fill	Chapter 3, pp 5, 6, 9, 22, 23 Appendix G	Chapter 4, pp 35, 36, 38, 41,	Volume II
Coastal Access CA-1 Maintenance of Public Access to Coastal Water CA-2 Increased Public Access CA-3 Enhanced Public Access	Chapter 3, pp 35-37, 38-40 Appendix G	Chapter 4, pp 5-7, 12, 29	N/A
Recreation INSERT AMSA policies	Chapter 3, pp pp 5-6,7-8,17-18, 27-29 Appendix G	Chapter 4, pp 36, 37, 41	Volume II
Natural Hazards NH-1 Appropriate Measures	Chapter 3, pp 36, 38-39 Appendix G	Chapter 4, pp 15-20	Volume II
Sand and Gravel Extraction SG-1 Sequencing of Coastal Extraction and Practicable Alternatives SG-2 Instream Material Extraction SG-3 Best Management Practices for Anadromous Waters SG-4 Reclamation and Restoration	Chapter 3, pp 39-40	Chapter 4, pp 13	N/A
Historic, Prehistoric, & Archeological Resources HPA-1 Appropriate Measures	Chapter 3, pp 39, 45 Appendix G	Chapter 4, pp 8-9	N/A
Transportation and Utilities TU-1 Visual Access TU-2 Corridor Consolidation and integration	Chapter 3, pp 10	Chapter 4, pp 40	N/A

APPENDIX C

Eyak Lake AMSA Enforceable Policies

APPENDIX C

EYAK LAKE AREA MERITING SPECIAL ATTENTION ENFORCEABLE POLICIES

1.1 INTRODUCTION AND DESIGNATION OF EYAK LAKE AMSA AS A RECREATIONAL USE AREA

The Alaska Coastal Management Act and the Guidelines and Standards that implement a local plan allow the establishment of an AMSA. AMSAs may be used in local coastal management plans as a management tool to recognize and protect "areas of unique, scarce, fragile or vulnerable natural habitat, cultural value, historical significance or scenic importance" and "substantial recreational value or opportunity."

In addition, a district may designate areas of recreational use. The entire Eyak Lake AMSA is designated a recreational use area because the area receives significant use by persons engaging in recreation and, in addition, has the potential for increased recreational use because of physical, biological, and cultural features.

1.2 PURPOSE

In recognition of the value of Eyak Lake to the City and Eyak Corporation, the major private landowner in the project area, the AMSA was designated and an AMSA plan was prepared. The AMSA plan was intended to provide for the development of recreational opportunities and maintenance of scenic values associated with Eyak Lake, while maintaining and improving the fishery production and the wildlife habitat values of the lake.

1.3 BOUNDARY

The Eyak Lake AMSA boundary can be described as follows:

On the south, the Copper River Highway from approximately Mile 7 west to the Eyak River Bridge; thence upslope from the south side of the highway to the 500-foot contour line and westerly along the 500-foot contour line to the extended projection of LeFevre Road; thence north along the projection and LeFevre Road and its extended projection to the base of Tripod Hill, which shall form the boundary on the west. The 500-foot contour line beginning at the base of Tripod Hill to a point where it crosses Power Creek above Ohman Falls; thence southerly along the east shore of Eyak Lake to the intersection with the section line between Sections 32 and 33; thence south along the section line to its junction with the Copper River Highway (point of beginning), which shall form the north and east boundaries.

1.4 RESOURCE INVENTORY AND ANALYSIS

The resource inventory and analysis is included with the original AMSA plan in Appendix G.

1.5 PROPER AND IMPROPER USES

Refer to these section headings in Chapter 7: Implementation

1.6 MATTER OF LOCAL CONCERN

Under State statutes, the enforceable policies of the District CMP must not address a matter regulated or authorized by state or federal law unless the enforceable policies relate specifically to a matter of local concern. A matter of local concern is a specific coastal use or resource within a defined portion of the district's coastal zone that is:

- (1) Demonstrated as sensitive to development,
- (2) Not adequately addressed by state or federal law, and
- (3) Of unique concern to the coastal resource district as demonstrated by local usage or scientific evidence.

For a designated recreation area, the "matter of local concern" test does not apply unless a proposed enforceable policy addresses a matter regulated or authorized by some other state or federal law not enumerated in the statewide standards. In this case, there are state and federal laws that may regulate or authorize the activities identified above. However, enforceable policies for an AMSA in effect on July 1, 2004, satisfy the requirements of (1) and (3) above (11 AAC 114.270(i)). Therefore, only (2) above must be satisfied here.

In terms of adequacy, the applicable laws are broad in scope and general in their application; more specificity is needed to determine whether a specific land or water use or activity will be allowed within the AMSA/designated area and to provide the management measures necessary to address the physical, biological, and cultural features of the area and to preserve, protect, enhance, and restore the recreational values (as permitted by 11 AAC 114.270(g) and required by 11 AAC 114.420(d)).

1.7 ENFORCEABLE POLICIES

The enforceable policies in Chapter 5, including those in the Coastal Development and Coastal Access sections, are applicable to the Eyak Lake AMSA.

In addition, the following enforceable policies are applicable within the Eyak Lake AMSA boundary and are necessary to preserve, protect, enhance, or restore the physical, biological, and cultural features upon which the recreational value depends.

1.7.1 Preservation, Protection, Enhancement, and Restoration of Physical Features

- | | |
|------|--|
| EL-1 | Only those uses, which require an over-water location, shall be permitted beyond the ordinary high water mark of the lake or inside the natural wetland boundary. |
| EL-2 | Where practicable, developments in or over the water, such as piers, docks, and protective structures shall be located, designed, and maintained in a manner that prevents adverse impacts upon air and water quality and fish, wildlife, scenic, and vegetative resources. |
| EL-3 | Adequate building setbacks from lake and stream waters and wetlands shall be established and maintained. These setbacks shall be a minimum of 20 feet from any part of a structure to the ordinary high water mark of the lake. Structures in existence at the time of adoption of this plan that are destroyed or damaged may be rebuilt within the existing foundation line. |

- EL-4 Structures or development of uses accessory to residential use (storage shed, well house, garage, etc.) shall retain shoreline open space, be visually and physically compatible with adjacent cultural and natural features, and be reasonable in size and purpose. Such development shall not be permitted in required shore setback spaces, or permitted over water unless clearly water-dependent, such as piers and floats.
- EL-5 The design of structures near watercourses shall preserve stream bank and channel integrity, reduce the impact of flooding, and allow for natural drainage.
- EL-6 The natural water circulation patterns in the lake shall be maintained and essential geo-hydraulic processes of accretion, transport, and erosion shall not be interrupted.
- EL-7 No development shall take place without providing adequate measures to provide for natural surface drainage runoff. Storm water runoff controls sufficient to prevent water quality degradation shall be imposed on development adjacent to Eyak Lake and adjoining tributaries.
- EL-8 Clearing and grading operations shall be conducted in a manner so as to prevent soil erosion and sediment runoff into Eyak Lake and adjoining tributaries. Surface modification that would induce excessive erosion or undermine the support of nearby land shall be prohibited. The developer is responsible for utilizing the best available erosion control measures to minimize erosion and sediment runoff during clearing and construction of a proposed project. The developer will be responsible for submitting a plan to permitting agencies stating how cleared land will be stabilized to prevent future erosion and sedimentation of the lake.
- EL-9 Uplands shall be managed to retain natural drainage patterns and vegetation cover on steep slopes (70 percent or greater), and along shorelines and stream banks to prevent excessive runoff and erosion and protect surface water quality and natural ground water recharge areas.

1.7.2 Preservation, Protection, Enhancement, and Restoration of Biological Features

- EL-10 Maintenance and enhancement of spawning areas shall be given priority consideration for shorelines. Shorelines having banks, beaches, and beds critical to the preservation of the fisheries resource base, as lake and stream spawning areas, shall be maintained in their productive natural condition.
- EL-11 Facilities for storing and distributing fuel shall not be located within the active floodplain of a stream.
- EL-12 In freshwater marshes and wetlands, maintenance of the natural functions is the highest priority. Development is prohibited except where it will not alter the natural functions of fish and wildlife habitat and where it meets a greater long-term public need.
- EL-13 All public works activities such as transportation projects, utilities, sewers, and drainage activities shall protect any freshwater marshes and wetlands from adverse impacts unless there is significant public need for a proposed use or activity for which no practicable alternative exists and all practicable steps have been taken to maximize conformance with the AMSA plan policies.
- EL-14 Adverse impacts to the areas adjacent to the eastern shore of the Eyak Lake from the mouth of Hatchery Creek to the ADF&G weir, including the wetland north of the Copper River Highway and east to the AMSA boundary, shall be minimized to protect the

biological resources principally using this area. These resources include the feeding and resting birdlife – nesting eagles, swans, and loons in particular. Birdlife shall be protected from disturbance, especially from discharge of firearms and motorized vehicles and equipment during freezeup conditions.

1.7.3 Preservation, Protection, Enhancement, and Restoration of Recreation and Scenic Values

- EL-15 Points of recreational and visual access to the shoreline and stream deltas shall be provided and protected, consistent with public safety and private property rights.
- EL-16 The ADOT&PF shall maintain the identified highway pullouts for scenic and viewing purposes.
- EL-17 Recreation and access developments shall preserve or enhance scenic views and vistas, as well as improve the aesthetic value of the area.
- EL-19 Utilities shall be installed underground wherever practicable.
- EL-20 Off-road vehicles such as snow machines, airboats, and 3-wheelers are prohibited on the Power Creek Delta, the wetland adjacent to Southeast Arm, and all lake tributary streambeds, except as necessary for public health and safety and maintenance and patrol of private lands by authorized persons.
- EL-21 Off-road vehicles shall be limited to designated routes and/or areas to ensure protection of users and resource values, and to minimize conflicts.
- EL-22 Eyak Lake waters shall be kept free of hazardous or obstructive development that could create a hazard to recreational use of the waters. In- water structures and buoys shall be visibly marked.
- EL-23 Public beach designations, swimming areas, camping sites, toilets, and picnic facilities shall be established and existing facilities improved where public need warrants and public funding is available.
- EL-24 The following areas and trails shall be retained, classified, and/or managed as recreation resources in accordance with applicable statutory requirements and private property rights. The current managing agency is shown for each area.
 - a) Boat ramp (City) - east end of runway.
 - b) North shore beach (ADNR) - boat launch and picnic area.
 - c) Nirvana Park (City) - picnic and group use.
 - d) The Spit (City) - swimming, picnicking, viewing, floatplane moorage.
 - e) Skater's Cabin (City) - picnic, skating, swimming, trailhead and group use.
 - f) Hatchery Creek culvert crossing (Eyak and ADOT&PF) - spawning fish and bear viewing.
 - g) Power Creek Road turnouts (ADOT&PF) - wildlife and scenic viewing, informal picnicking.
 - h) Power Creek trail (USFS) - hiking and access.
 - i) Crater Lake trail (ADNR) - hiking and access.
 - j) CRH turnouts (ADOT&PF) - scenic viewing.

- k) Mavis Island and causeway (ADNR) - public recreation.
- l) Eyak River Bridge turnout (ADOT&PF) - swan viewing, trailhead for Eyak River Trail, scenic point.

APPENDIX D

Definitions

APPENDIX D

DEFINITIONS

A number of the terms used in coastal management have specific regulatory or procedural meaning. To clarify the intent of the coastal management policies, the following definitions apply to language used in the plan policies.

ACMP is the Alaska Coastal Management Program.

Active floodplain of watercourses is the portion of a floodplain that is periodically inundated or encompassed by a mean annual flood ($Q = 2.33$ flood frequency) and is characterized by active flowing channels, high water channels and adjacent unvegetated or sparsely vegetated bars.

Adjacent has the same meaning as in State law.

11 AAC 112.990 (a) (2) "adjacent" means near but not necessarily touching; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

AMSA has the same meaning as in State law.

AS 46.40.210 (1) "area which merits special attention" means a delineated geographic area within the coastal area which is sensitive to change or alteration and which, because of plans or commitments or because a claim on the resources within the area delineated would preclude subsequent use of the resources to a conflicting or incompatible use, warrants special management attention, or which, because of its value to the general public, should be identified for current or future planning, protection, or acquisition; these areas, subject to council definition of criteria for their identification, include:

- (A) areas of unique, scarce, fragile or vulnerable natural habitat, cultural value, historical significance, or scenic importance;*
- (B) areas of high natural productivity or essential habitat for living resources;*
- (C) areas of substantial recreational value or opportunity;*
- (D) areas where development of facilities is dependent upon the utilization of, or access to, coastal water;*
- (E) areas of unique geologic or topographic significance which are susceptible to industrial or commercial development;*
- (F) areas of significant hazard due to storms, slides, floods, erosion, or settlement; and*
- (G) areas needed to protect, maintain, or replenish coastal land or resources, including coastal flood plains, aquifer recharge areas, beaches, and offshore sand deposits;*

Avoid has the same meaning as in State law.

11 AAC 112.900. Sequencing process to avoid, minimize, or mitigate. (a) As used in this chapter and for purposes of district enforceable policies developed under 11 AAC 114, "avoid, minimize, or mitigate" means a sequencing process of

- (1) avoiding adverse impacts to the maximum extent practicable; (2) where avoidance is not practicable, minimizing adverse impacts to the maximum extent practicable; or (3) if neither avoidance nor minimization is practicable, conducting mitigation to the extent appropriate and practicable; for purposes of this paragraph, "mitigation" means
- (A) on-site rehabilitation of project impacts to affected coastal resources during or at the end of the life of the project; or
- (B) to the extent on-site rehabilitation of project impacts is not practicable, substituting, if practicable, rehabilitation of or an improvement to affected coastal resources within the district, either on-site or off-site, for a coastal resource that is unavoidably impacted.

(b) For a project that requires a federal authorization identified under 11 AAC 110.400, the coordinating agency shall consult with the authorizing federal agency during that federal agency's authorization review process to determine whether the mitigation requirements proposed by the federal agency for that federal authorization would satisfy the mitigation requirements of (a)(3) of this section. If the coordinating agency determines that the mitigation requirements proposed by the federal agency would not satisfy the mitigation requirements of (a)(3) of this section, the coordinating agency shall require appropriate mitigation in accordance with (a)(3) of this section.

(c) For purposes of (a)(3) of this section, a determination of practicability includes the consideration of the following factors, as applicable: (1) the magnitude of the functional values lost by the impacted coastal resources;

- (2) the likelihood that the mitigation measure or improvement will succeed in actually rehabilitating the impacted coastal resources; and
- (3) the correlation between the functional values lost by the coastal resources impacted and the proposed mitigation measure or improvement.

(d) To the extent feasible and not otherwise addressed by state or federal law, any requirements imposed under (a)(3) of this section for mitigation through on-site or off-site rehabilitation of project impacts shall be established by the coordinating agency at the time of the project's consistency review under 11 AAC 110.

(e) In applying the mitigation process described in (a)(3) of this section, unless required by a federal agency issuing an authorization identified under 11 AAC 110.400 for the project, the coordinating agency may not require

- (1) that no net loss of impacted coastal resources occur; or
- (2) monetary compensation. (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

Base Flood means the flood having one percent chance of being equaled or exceeded in any given year. Also referred to as the 100-year flood.

Coastal Processes are the collective results of physical, oceanographic, and meteorologic influences on the geographic landforms and nearshore waters of the Lake and Peninsula Borough. Coastal processes are also influenced by freshwater discharges from major river drainage systems and suspended sediments transported by rivers to coastal waters. Key features of coastal processes are shoreline erosion and accretion.

Coastal Waters has the same meaning as in state law.

11 AAC 112.990. Definitions. (6) "coastal water" means those waters, adjacent to the shorelines, that contain a measurable quantity or percentage of sea water, including sounds, bays, lagoons, ponds, estuaries, and tidally influenced waters; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

Consistency means compliance with the standards of the ACMP, including the enforceable policies of this approved coastal plan.

Consistent to the maximum extent practicable means that federal government activities or uses, including development projects affecting the coastal zone of Alaska, are fully consistent with the standards of the ACMP unless compliance would violate another federal law (15 CFR 930.32.(a)).

Cumulative Impacts has the same meaning as in State law.

11 AAC 110.990. Definitions. (a) (19) "cumulative impacts" means reasonably foreseeable effects on a coastal use or resource that result from the incremental impact of an individual project when viewed together with the impacts of past and currently authorized projects; (Eff. 7/1/2004, Register 170)

DEC is the Alaska Department of Environmental Conservation.

DF&G is the Alaska Department of Fish and Game.

Direct and significant impact has the same meaning as in State law.

11 AAC 114.990. Definitions. (13) "direct and significant impact" means an effect of a use, or an activity associated with the use, that will proximately contribute to a material change or alteration of the coastal waters, and in which
(A) the use, or activity associated with the use, would have a net adverse effect on the quality of the resources;
(B) the use, or activity associated with the use, would limit the range of alternative uses of the resources; or
(C) the use would, of itself, constitute a tolerable change or alteration of the resources but which, cumulatively, would have an adverse effect; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

Development means any man-made change to improved or unimproved lands and coastal waters, including but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling.

DNR is the Alaska Department of Natural Resources.

Due deference has the same meaning as in State Law.

11 AAC 110.990. Definitions. (a) (25) "due deference" means that deference that is appropriate in the context of
(A) the commentor's expertise or area of responsibility; and
(B) all the evidence available to support any factual assertions of the commentor; (Eff. 7/1/2004, Register 170)

Environmentally Responsible means consistent with coastal resource protection and performance standards of this plan, and incorporating current best management practices with

protection measures commensurate with the values of habitats affected.

Estuary has the same meaning as in State law.

11 AAC 11.990 Definitions. (11) "estuary" means a semiclosed coastal body of water that has a free connection with the sea and within which seawater is measurably diluted with freshwater derived from land drainage; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

Facilities related to commercial fishing and seafood processing has the same meaning as in State law.

11 AAC 114.990. Definitions. (17) "facilities related to commercial fishing and seafood processing" includes hatcheries and related facilities, seafood processing plants and support facilities, marine industrial and commercial facilities, and aquaculture facilities; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

Feasible and prudent means consistent with sound engineering practice and not causing environmental, social, or economic problems that outweigh the public benefit to be derived from compliance with the standard which is modified by the term "feasible and prudent".

Flood – an overflow or inundation of normal dry lands from a stream or other body of water; the high streamflow overtopping the banks of a stream; or a high flow as measured by either stage or discharge.

Floodway means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height, usually one foot, at any point.

Geophysical Hazard is a condition created by a geological process, topography, water drainage, or unique weather condition that presents a significant hazard to life and property.

Important fishing areas are areas used consistently over time for commercial, sport, or subsistence fishing. Fishing includes harvesting marine invertebrates and plants.

Important habitats has the same meaning as in State law.

11 AAC 112.300. Habitats. (c) For purposes of this section,
(1) **"important habitat"** means habitats listed in (a)(1) – (8) of this section and other habitats in the coastal area that are
(A) designated under 11 AAC 114.250(h);
(B) identified by the department as a habitat
(i) the use of which has a direct and significant impact on coastal water; and
(ii) that is shown by written scientific evidence to be significantly more productive than adjacent habitat;
or
(C) identified as state game refuges, state game sanctuaries, state range areas, or fish and game critical habitat areas under AS 16.20; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

Local knowledge has the same meaning given in State law except that “generally accepted by the local community” is that body of knowledge that is reflected in local plans, studies, policies and standards.

11 AAC 114.990. Definitions. (22) "local knowledge" means a body of knowledge or information about the coastal environment or the human use of that environment, including information passed down through generations, if that information is
(A) derived from experience and observations; and
(B) generally accepted by the local community; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

Maintain means to provide for continuation of current conditions and functions.

Mariculture is the captive cultivation of plants and animals in marine and estuarine waters for human consumption.

Mean High Water has the same meaning as in State law.

11 AAC 53.900 (14) "mean high water" means the tidal datum plane of the average of all the high tides, as would be established by the National Geodetic Survey, at any place subject to tidal influence; (Eff. 3/27/80, Register 73; am 7/5/2001, Register 159)

Mean Higher High Water is the average of all the daily higher high water recorded over a 19-year period or a computed equivalent period. It is usually associated with a tide exhibiting mixed characteristics.

Mean Low Water has the same meaning as in State law.

11 AAC 53.900 (16) "mean low water" means the tidal datum plane of the average of all the low tides, as would be established by the National Geodetic Survey, at any place subject to tidal influence; (Eff. 3/27/80, Register 73; am 7/5/2001, Register 159)

Mean Lower Low Water has the same meaning as in State law.

11 AAC 53.900 (17) "mean lower low water" means the tidal datum plane of the average of the lower of the two low waters of each day, as would be established by the National Geodetic Survey, at any place subject to tidal influence; (Eff. 3/27/80, Register 73; am 7/5/2001, Register 159)

Minimize has the same meaning as in State law (see Avoid, Minimize and Mitigate).

Mitigate has the same meaning as in State law (see Avoid, minimize and Mitigate).

Natural Hazards has the same meaning as in State law.

11 AAC 112.990. Definitions. (15) "natural hazards" (A) means the following natural processes or adverse conditions that present a threat to life or property in the coastal area: flooding, earthquakes, active faults, tsunamis, landslides, volcanoes, storm surges, ice formations, snow avalanches, erosion, and beach processes;
(B) includes other natural processes or adverse conditions designated by the department or by a district in a district plan; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

One Hundred Year Flood is a flood of a magnitude, which can be expected to occur on an average of once every 100 years. It is possible for this size flood to occur during any year, and possible in successive years. It would have a one percent chance of being equaled or exceeded in any year. Statistical analysis of available stream flow or storm records, or analysis of rainfall or runoff characteristics of the watershed, or topography and storm characteristics are used to determine the extent and depth of the 100-year flood.

OPMP is the Office of Project Management and Permitting with the Department of Natural Resources.

Ordinary high water has the same meaning as in State law.

11 AAC 53.900 (23) "Ordinary high water" means the mark along the bank or shore up to which the presence and action of non-tidal water are so common and usual, and so long continued in all ordinary years, as to leave a natural line impressed on the bank or shore and indicated by erosion, shelving, changes in soil characteristics, destruction of terrestrial vegetation, or other distinctive physical characteristics. ; (Eff. 3/27/80, Register 73; am 7/5/2001, Register 159)

Practicable has the same meaning as in State law.

11 AAC 112.990. Definitions. (18) "practicable" means feasible in light of overall project purposes after considering cost, existing technology, and logistics of compliance with the standard; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

Proper and improper uses are the can-do and can't-do uses for the area.

Public need has the same meaning as in State law except that "documented" includes those needs expressed in locally adopted plans, studies, policies and standards.

11 AAC 114.990 (35) "public need" means a documented need of the general public and not that of a private person; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

Resource agency has the same meaning as in State law.

Sec. 46.39.010. (2) "resource agency" means
(A) the Department of Environmental Conservation;
(B) the Department of Fish and Game; or
(C) the Department of Natural Resources.

Saltwater wetlands has the same meaning as in State law. (see also "wetlands")

11 AAC 112.990. Definitions. (25) "saltwater wetlands" means those coastal areas along sheltered shorelines characterized by halophilic hydrophytes and macroalgae extending from extreme low tide to an area above extreme high tide that is influenced by sea spray or tidally induced water table changes; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

Shall means mandatory; it requires a course of action or set of conditions to be achieved.

Should states intent for a course of action or set of conditions to be achieved. This implies that case-specific discretion may be applied for achieving the intent of the action.

Significant adverse impact means an impact as indicated in state law by “direct and significant impact”.

Subject uses is a description of the land and water uses and activities which are subject to the district plan.

Subsidence is a lowering in elevation of ground surface due to underground geologic or hydrologic change. It can be a common occurrence in areas susceptible to seismic activity and where excessive water table depletion occurs.

Subsistence Use Areas are coastal habitat areas, used traditionally or occasionally in response to seasonal or cyclic resource abundance, where subsistence harvests of fish, wildlife, and other biological resources are conducted.

Subsistence uses has the same meaning as in State law.

AS 16.05.940 (33) "subsistence uses" means the noncommercial, customary and traditional uses of wild, renewable resources by a resident domiciled in a rural area of the state for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumption, and for the customary trade, barter, or sharing for personal or family consumption; in this paragraph, "family" means persons related by blood, marriage, or adoption, and a person living in the household on a permanent basis; (Eff. ///; Register)

Surface Waters include streams, rivers, ponds, lakes, and contiguous open water wetlands.

Tsunami is a great sea wave produced by submarine earth movements or volcanic eruption.

Uses of state concern has the meaning as in State law.

AS 46.40.210 (12) "uses of state concern" means those land and water uses that would significantly affect the long-term public interest; "uses of state concern" include

(A) uses of national interest, including the use of resources for the siting of ports and major facilities that contribute to meeting national energy needs, construction and maintenance of navigational facilities and systems, resource development of federal land, and national defense and related security facilities that are dependent upon coastal locations;

(B) uses of more than local concern, including those land and water uses that confer significant environmental, social, cultural, or economic benefits or burdens beyond a single coastal resource district;

(C) the siting of major energy facilities, activities pursuant to a state or federal oil and gas lease, or large-scale industrial or commercial development activities that are dependent on a coastal location and that, because of their magnitude or the magnitude of their effect on the economy of the state or the surrounding area, are reasonably likely to present issues of more than local significance;

(D) facilities serving statewide or interregional transportation and communication needs; and

(E) uses in areas established as state parks or recreational areas under AS 41.21 or as state game refuges, game sanctuaries, or critical habitat areas under AS 16.20.

Water-Dependent has the same meaning as in State law.

11 AAC 112.990. Definitions. (31) "water-dependent" means a use or activity that can be carried out only on, in, or adjacent to a water body because the use requires access to the water body;

(32) "water-related" means a use or activity that is not directly dependent upon access to a water body, but which provides goods or services that are directly associated with water-dependence and which, if not located adjacent to a water body, would result in a public loss of quality in the goods or services offered; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

Waterfront means the area along the coastline between mean higher high water and mean high sea level.

Water-Related has the same meaning in State law.

Wetlands has the same meaning as in State law.

11 AAC 112.990. Definitions. (33) "wetlands" means saltwater wetlands and those freshwater wetlands that have a direct drainage to coastal waters; (Eff. 7/1/2004, Register 170; am 10/29/2004, Register 172)

APPENDIX E

List of Abbreviations and Acronyms

APPENDIX E

LIST OF ABBREVIATIONS AND ACRONYMS USED

AAC	Alaska Administrative Code
ACMP	Alaska Coastal Management Program
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ADOL	Alaska Department of Labor
ADOT&PF	Alaska Department of Transportation and Public Facilities
Air Force	U.S. Air Force
AMSA	Area Meriting Special Attention
AS	Alaska Statute
CFR	Code of Federal Regulations
City	City of Cordova
CMP	Coastal Management Plan
CNF	Chugach National Forest
CRM	Copper River Meridian
District	Cordova Coastal District
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
gpm	gallons per minute
ISER	Institute for Social and Economic Research
mg/l	milligrams per liter
mph	miles per hour
NRHP	National Register of Historic Places
OHW	Ordinary High Water
OPMP	Office of Project Management and Permitting
P.L.	Public Law
ppm	parts per million
ppsf	pounds per square foot
STIP	Statewide Transportation Improvement Program
TSA	Tourism Satellite Account
TSP	total suspended particulates

APPENDIX F

References

APPENDIX F

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APPENDIX G

Scanned 1985 Eyak Lake AMSA Resource Inventory and Analysis

Scanned 1985 Eyak Lake Issues of Concern, Goals, and Objectives

EYAK LAKE AMSA
COOPERATIVE MANAGEMENT PLAN

CONCEPTUALLY APPROVED

March, 1985

Prepared For
The Eyak Lake AMSA Study Team

By
Professional Fishery Consultants
Cordova, Alaska

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De Eyak Lake ANSA Study Team Consists of Representatives
of the Following Organizations

Alaska Department of Community and Regional Affairs

Alaska Department of Environmental Conservation

Alaska Department of Fish and Game

Alaska Department of Natural Resources

Alaska Department of Transportation / Public Facility

Alaska Office of Coastal Management

City of Cordova

Eyak Corporation

United States Fish and Wildlife Service

United States Forest Service

The Eyak Corporation was afforded the opportunity to participate in the development of this report but chose not to do so.

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INTRODUCTION

On February 9, 1981, the Alaska Coastal Policy Council met in Cordova and approved the Cordova Coastal Management Program as submitted by the City of Cordova. In its approval action, the Council made several recommendations including preparation of a cooperative management plan for Eyak Lake by the City and affected private landholders and public agencies. As only a small portion of Eyak Lake is located within municipal limits, the City did not feel it appropriate to include that small portion within its coastal area, and suggested the appropriate time to develop a plan for Eyak Lake would be when the entirety of the Lake could be included in a single planning effort. The Coastal Policy Council recommended the City, in cooperation with appropriate State agencies and other affected parties, identify Eyak Lake as an Area Meriting Special Attention (AMSA) and proceed with preparing such a cooperative plan.

AUTHORIZATION

In recognition of the value of Eyak Lake to the City of Cordova and to Eyak Corporation, the major private landowner in the Project Area, the City and Eyak Corporation, together with the State and Federal agencies concerned with the lake, have agreed that special management efforts are needed to protect the Lake's water quality, fish and wildlife habitats, and recreational values while accommodating probable future development adjacent to Eyak Lake. In order to formulate and guide this management plan, a Study Team was formed with the City of Cordova assigned the role of lead agency. The study team consists of representatives of the following organizations: City of Cordova, Eyak Corporation, State Office of Coastal Management, Alaska Department of Community and Regional Affairs, Alaska Department of Environmental Conservation, Alaska Department of Fish and Game, Alaska Department of Natural Resources, Alaska Department of Transportation/Public Facilities, U.S. Fish and Wildlife Service, and the U.S. Forest Service.

The project was carried out to the extent possible through a consensus effort. If the Study Team is unable to arrive at a consensus position in the Study Team Final Report, the State Coastal Policy Council will be the final arbitrator of any policy decisions regarding the proposed AMSA designation. On February 27, 1981, the Study Team conducted its first meeting where the problem was defined, the issues spelled out, data needs identified, the work program outlined and a course of future action chosen. As a result of that meeting in which the decision was made to contract the Study, a Request for Proposals was issued that included a Scope of Services that basically outlined the required work and time frames.

The City of Cordova entered into a contract with the Department of Community and Regional Affairs to carry out the Scope of

Services by way of a grant received through the Alaska Coastal Management Program.

The City of Cordova on September 9, 1981, entered into an agreement with Professional Fishery Consultants of Cordova, Alaska, for completing all work program tasks and study products specified in the Scope of Services culminating in a management plan for Eyak Lake.

The plan shall comply with 6 AAC 80.160 AREAS WHICH MERIT SPECIAL ATTENTION of the Standards and Guidelines of the Alaska Coastal Management Program.

PURPOSE AND SCOPE

The purpose of the work program is to develop an AMSA proposal for Eyak Lake to fulfill the Study Team's project goals as defined below and implement the Coastal Policy Council's recommendation.

The goals of this project are to develop objectives, policies and actions to:

- (1) maintain and/or improve the water quality of Eyak Lake;
- (2) maintain and/or improve the fishery production of Eyak Lake;
- (3) maintain and/or improve the wildlife habitat values associated with Eyak Lake;
- (4) accommodate existing and appropriate future residential, commercial, and facilities development within the planning area;
- (5) develop and maintain recreational opportunities and maintain the scenic values associated with Eyak Lake.

Shown in Figure 1 is the project area covered by this study. The boundary is described as: On the south, the Copper River Highway from approximately Mile 7 west to the Eyak River Bridge; thence upslope from the south side of the highway to the 500 foot contour line and westerly along the 500 foot contour line to the extended projection of LeFevre Road; thence north along the projection and LeFevre Road and its extended projection to the base of Tripod Hill which shall form the boundary on the west. The 500 foot contour line beginning at the base of Tripod Hill to a point where it crosses Power Creek above Ohman Falls; thence southerly along the east shore of Eyak Lake to the intersection with the section line between Sections 32 and 33; thence south along the section line to its junction with the CRH (point of beginning) which shall form the north and east boundaries.

ACKNOWLEDGEMENTS

A unique partnership was formed at the advent of this project composed of the Study Team and the Contractor. The uniqueness derives from the manner in which the study was conducted -- at various points along the way the progress and proposed action was reviewed by the Study Team resulting in renewed direction for the Contractor. A most significant aspect of this approach will, as a result of the Contractor's Draft Plan, cause the Study Team and Contractor to negotiate a final management scheme in which all parties having management authority in the project area will have agreed on management direction for the management plan. Throughout the study the Study Team has responded in a significant way and has materially aided the progress to date. Special thanks go to Mr. Perry Lovett, past City Manager; Mr. Malcolm (Mac) MacMaster, Utilities Superintendent; Mr. Robert Krebs, past Planning Coordinator, and Mr. David Dengel, current Planning Coordinator, for their valuable assistance from the City of Cordova. Additionally, the local staffs of the Alaska Department of Fish and Game and the Chugach National Forest helped in many ways. We thank Ms. Mary Mueller of Sitka and Mr. Alan Batten of the University of Alaska Museum for their help in aquatic plant identification, and Mr. Dave Bartow of Prince William Sound Aquaculture Corporation for his suggestions on limnological and bathymetric sampling. Thanks also to Mr. Rae Baxter for assistance in identifying the molluscs.

EYAK LAKE AMSA COOPERATIVE MANAGEMENT PLAN



Alaska Coastal Management Program
The Alaska Department of Natural Resources
in cooperation with the U.S. Environmental Protection Agency
and the U.S. Army Corps of Engineers
has prepared this plan for the Eyak Lake area.

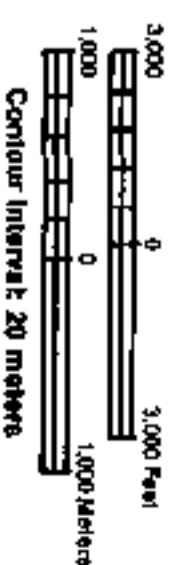
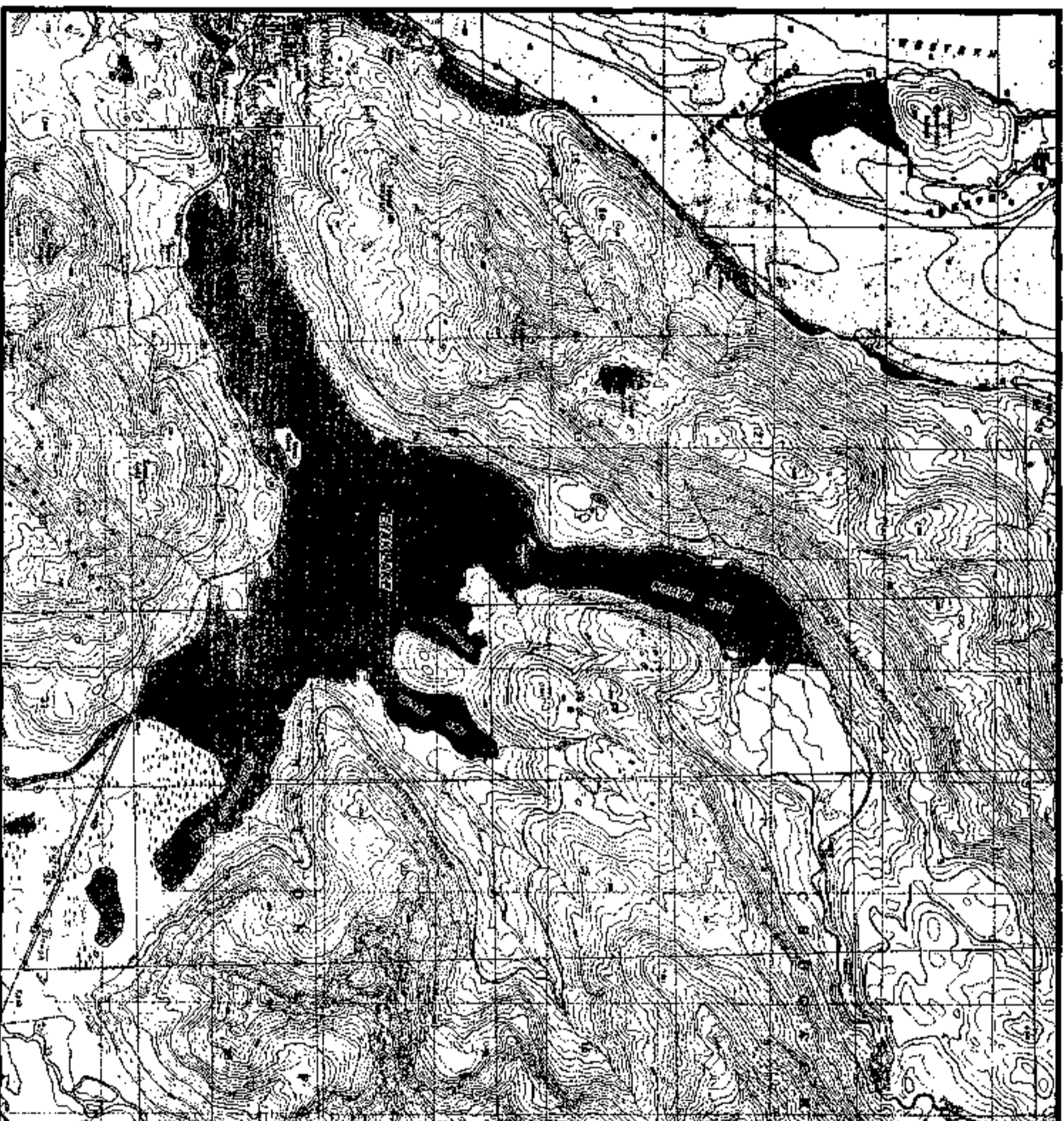


Figure 1

CHAPTER ONE: PHYSICAL DESCRIPTION

Eyak Lake is a shallow body of fresh water located adjacent to the City of Cordova with approximately 9% of the lake being within the city limits. The map in Figure 2 will be helpful in visualizing the description. The lake is shaped like a three-armed starfish (or "Y"-shaped) and is immediately surrounded by mountains ranging in heights of 2100 to 3500 feet. Gaps in this mountain perimeter are located at the tip of each of the arms the "Eyak Gap" at the tip of the southeast arm that opens out onto the Copper River Delta, the gap at the tip of the west arm that opens into Orca Inlet and is the general location of the City of Cordova developed area, and Power Creek Valley extending northeasterly from the tip of the north arm.

Twenty-four hundred acre Eyak Lake has 18.9 miles of shoreline, an average depth of less than 8 feet, and a greatest depth of approximately 23 feet. Bathymetry for the lake is shown in Figure 3. The methodology used to determine the bathymetry consisted of running transects across the lake by boat between various points around the lakeshore and continuously recording the depths on a recording fathometer after which the transects were plotted on a map and the contours interpolated from the plotted data. The channels were plotted in the same way along with the aid of aerial photo interpretation. The lake is flat-bottomed (very flat) averaging six to eight feet deep with the exception of the gutters or stream channels cut into the lake bottom which vary from 1-1/2 feet to 12 feet deeper than the surrounding bottom. It is questionable how the channels formed, but if the lake area was ever a tidal flat that drained toward Eyak River, Orca Inlet, or both, that would account for the channel pattern.

The lake bottom substrate is generally mud in the form of silt ranging from soft to hard-packed and occasionally overlain with organic matter or slightly mixed with organic matter. Around the shoreline usually in depths less than five or six feet, is generally a ribbon of gravel extending out from shore from several feet to as much as 170 feet in delta areas of small streams. In some areas this "ribbon" has a large percentage of rock and, in a very few areas, sand or a mixture of gravel, sand and rock.

At least fifteen aquatic plant species inhabit the lake (see list of plants in Appendix E), one of which has not been identified in Alaska prior to this study. The plant with the first recorded siting in Alaska is Elodea canadensis Michx., Frog's-bit (Batten, 1983; Mueller, 1981; personal communications). Aquatic plants cover virtually the entire bottom of Eyak Lake in densities ranging from a few plants per square foot to thick masses of vegetation. Generally no plants grow in the gravel strip around the shoreline - only in the mud bottom. Both this substrate data and the aquatic plant data were collected along the bathymetry transects at regular intervals using grab samples and supplementing this data with visual observations through the ice.

The lake drains at the southeastern tip through Eyak River into the Gulf of Alaska. A sheet pile weir, established after the 1964 earthquake to maintain lake level, is located at the outlet. The lake water surface lowered during the earthquake as the Cordova region was uplifted approximately six feet. Prior to the quake the Copper River flats gillnet fleet was able to use Eyak River to go to and from the fishing grounds tying up at "the spit" during closed fishing periods. Now the weir prevents passage into the lake of all but the smallest boats. Elevation at the top of the weir equals 17.5 feet above ocean datum 0.00' MLLW.

Besides the watershed surrounding the lake, Power Creek watershed is the major contributing water source for Eyak Lake. U.S. Geological Survey established stream gauging station No. 15216000 on Power Creek about 1-1/2 miles downstream from Ohman Falls in July, 1913. Eyak Lake's drainage area above the weir site is 40.5 square miles while that portion above the gaging station on Power Creek is 20.5 square miles, and that between the weir and gaging station is 20.0 square miles (Lyon Associates, 1970). National Weather Service data indicate that 27 percent of the Power Creek Basin is covered by glaciers. Power Creek flows from Shepard Glacier through a steep walled valley to Eyak Lake.

An ancient landslide bisects the valley just above Ohman Falls with a large fan-shaped ridge 300 to 400 feet in height. This landslide dammed Power Creek forming a large lake upstream of Ohman Falls where glacial precosses produced rapid infilling of this lake with silt, sand and gravel until the natural dam was breached and the recent valley was cut to the present configuration of Power Creek. Ohman Falls drops 175 feet in a horizontal distance of approximately 500 feet, and then the creek falls about 200 feet in the remaining 1-1/2 miles to Eyak Lake (Stone & Webster, 1982).

LAND STATUS

The City of Cordova controls land uses within its corporate limits which extend eastward from Orca Inlet to approximately the midpoint of the west arm of Eyak Lake (the City basically has jurisdiction over the land surrounding the west half of West Arm). (See Figure 3). Land along both the north and south shores of the eastern half of West Arm is state land while the Eyak Corporation (a Native village corporation), through the Alaska Native Claims Settlement Act (ANCSA), has interim conveyance to title on the land surrounding the remainder of the lakeshore except for existing individual private homesites. In general terms, Eyak Corporation land entitlement surrounds the eastern three-fourths of Eyak Lake shoreline.

Once federal lands of the Chugach National Forest were dominant immediately adjacent to Cordova and Eyak Lake, but the state and Native corporation selections have relegated federal ownership to the higher, less desirable country back from the lake edge and road system.

EYAK LAKE AMSA COOPERATIVE MANAGEMENT PLAN



Alaska Coastal Management Program
This map is a cooperative effort between the Alaska Department of Natural Resources and the U.S. Army Corps of Engineers. It is a product of the Alaska Coastal Management Program, which is a cooperative effort between the Alaska Department of Natural Resources and the U.S. Army Corps of Engineers. The map is a product of the Alaska Coastal Management Program, which is a cooperative effort between the Alaska Department of Natural Resources and the U.S. Army Corps of Engineers.

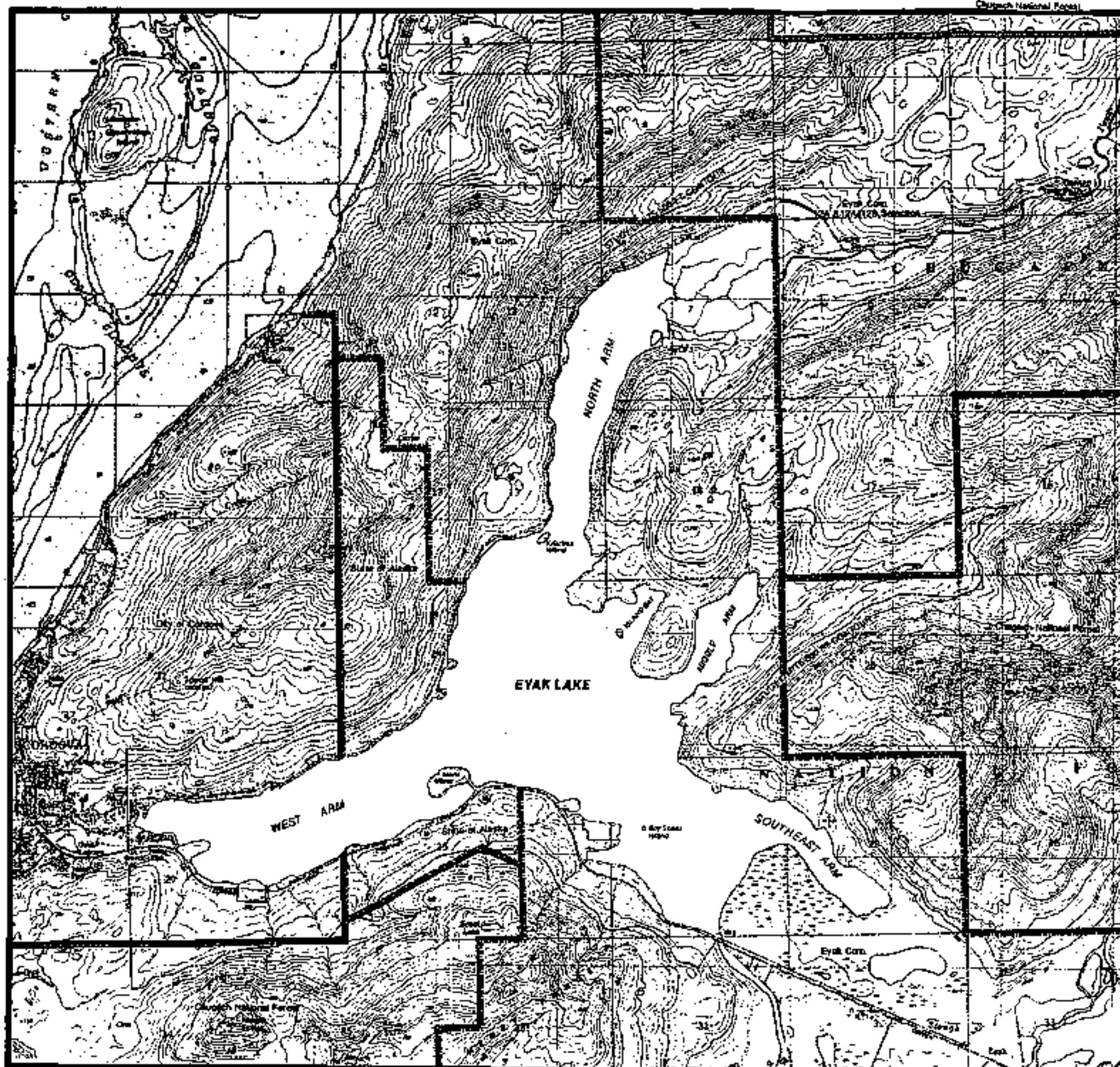
EYAK LAKE BATHYMETRY

— Bathymetry Showing 20-foot Contour Lines
— Lake Channels with Channel Depths



Contour Interval: 20 meters

Figure 2



EYAK LAKE AMSA COOPERATIVE MANAGEMENT PLAN



Alaska Coastal Management Program
 The purpose of this program is to provide a framework for the development of coastal management plans for the State of Alaska. The program is designed to provide a framework for the development of coastal management plans for the State of Alaska. The program is designed to provide a framework for the development of coastal management plans for the State of Alaska.

LAND OWNERSHIP MAP

- Cordova City Limits
- ▬ State Land Boundary
- ▬ Eyak Corp. B2A & V2A12B Selection Boundary
- ▬ Eyak Corp. Boundary
- ▬ Chugach National Forest Boundary
- ▬ Private Lands



Figure 3

Land jurisdictional boundaries are not static at this time as the state is entitled to select additional land under the Statehood Act, some of which could come from the Cordova area, and the village and regional Native corporation selections have not been completely resolved. Much of the land behind (from the viewpoint of the lakeshore) the Eyak Corporation land has been identified by the village and regional Native corporations under ANCSA Sections 12A and 12B and could become private land. Also, since the Eyak Corporation could not select lands within two miles of the corporate limits of the City of Cordova and a gap exists between the two mile limit and their current boundary, a further land adjustment will probably be in order. This would amount to the Eyak Corporation receiving title to the gap land, approaching the two mile limit line as closely as possible with a stair-stepping of quarter-quarter sections (40 acre square blocks) up to the two mile limit line.

Eyak Corporation has authority over their land (which is private land in every respect) to subdivide it into homesite sized parcels or develop it in any other way within the law.

The lake bed, stream and river beds of all navigable waterways are also state lands or shore lands as authorized by federal statute Public Law 31, Chapter 65, Section 2A of the Submerged Lands Act. Demarkation of these lands is done by determining the ordinary high water mark of the lake or stream if no survey has been done.

CLIMATE

The study area has a maritime climate with cool relatively mild winters, and heavy precipitation year round with a high incidence of cloudiness. The modifying influence of the ocean and the latitude cause relatively small seasonal and diurnal temperature variations. Strong winds and storms are common as broad storm tracks with their associated lows move up the Aleutians into the northern Gulf of Alaska throughout the year and pound this area of the coast with surface winds occasionally reaching 75 to over 100 m.p.h. The coastal storms in combination with the steep slopes of the surrounding mountains and the attendant air mass uplift are the causes of the heavy precipitation. Record breaking rains fell in Cordova during August 1981, when, from the 1st to the 17th of the month, 56.0 inches had been recorded with August 7 being the day of heaviest rainfall on record for that year in the city - 16.6 inches. Winds normally come out of the east, flowing and gusting into and across the study area from "Eyak Gap" and out of the West Arm, over the City of Cordova and into Orca Inlet. Average annual precipitation is 168 inches (14 feet) which includes 116 inches of snowfall. The number of cloudy days each year averages 262. Some additional climatic data is listed below from Alaska Regional Profiles: Southcentral Region (UofA, 1974).

Average temperature range: (deg. F) Summer 44 - 61, Winter 21 - 39
Extreme temperature range: (deg. F.) -23 to 81
Average wind: E 4.5 kts. (7.8 k.p.h.)

Average temperature in January: 23 deg. F. July: 54 deg. F.
Mean date of last Spring occurrence of 32 deg. F.: May 27
Mean date of first Fall occurrence of 32 deg. F.: September 13
Growing season w/temperatures above 40 deg. F.: 145 days

GEOLOGY

The best summary description of the geology of the study area appears in Cordova Power Supply Feasibility Analysis - Summary Progress Report by Stone and Webster (1982) and is quoted liberally below.

Eyak Lake is one of a set of weakly developed topographic lows - valleys trending northwest - in relation to the major northeast trending fjords along the coastline between Valdez and Kayak Island. These gross regional geomorphic trends are probably related to regional fracture patterns and major structural features resulting from the tectonic history of the area.

The rocks in the study area belong to the Orca Group which are slightly metamorphosed sedimentary series including thick bedded brown and gray sandstones, black limestones, arkoses with thin zones of slate and shale, and occasional conglomerate greenstones associated with highly mafic basalt flows. These rocks are highly deformed and fractured with extensive secondary quartz emplacement occurring along the fractures ranging in thickness from a fraction of an inch to several feet.

The structural geology is characterized by highly deformed rocks, tightly folded and faulted along a northeast orientation. This structural feature results from active subduction of the Pacific plate which is occurring along the southern coast of Alaska and extending westward along the Aleutian Island arc. A fault follows the course of Power Creek and dips to the northwest as shown on map of local major faults (Figure 5).

Turn-of-the-century investigators identified Power Creek as the best stream within the vicinity of Cordova for hydroelectric development. However, based on recent on-site geological and geotechnical investigations, the Corps of Engineers has eliminated the possibility of developing a large storage dam above Ohman Falls capable of regulating Power Creek. The type of material of the ancient landslide mass at Ohman Falls is a considerable concern. The absence of surface drainage within the landslide area indicates that this mass is highly permeable. It has been observed that there are no permanent streamflows across the mass and that none of the larger depressions, which reach a maximum depth of 100 feet, contain water. Also noted were numerous springs and seeps downstream of Ohman Falls at elevation 350 feet. The landslide mass probably consists of broken and jumbled fragments of the original sedimentary rocks typical of the area. They are now weak, highly permeable and in a stable configuration. Underground water flow is suggested and has been further verified by Jack Chisum of Chisum Flying Service, Cordova, while he was

serving the Power Creek drill sites by helicopter and flying over the area frequently. He observed mud flowing from the depressions ("spring holes") near the mouth of Hatchery Creek. Power Creek was running relatively clear at the time so the most obvious conclusion is that drilling mud entered underground flow routes above Ohman Falls and emerged in the "spring holes" in and near the lake. During the winter when surrounding water temperature was 32 deg. F., the water coming from these "spring holes" was 39 deg. F.

Power Creek carries a considerable sediment load, which is derived from several sources including stream channel erosion, mass wasting into the channel from steep adjacent slopes, and glacial and avalanche debris. The total annual sediment load in Power Creek has been conservatively estimated at 4.1 to 6.2 acre feet.

Most of the City of Cordova is built on argillite (shale-like) and graywacke (sandstone) bedrock, but the southside of the city is situated on unconsolidated fluvio-glacial deposits (glacial drift) at least 140 feet thick that fill a low divide between the waters of Orca Inlet and Eyak Lake.

NATURAL HAZARDS

Natural hazards exist in the study area ranging from common strong winds to occasional violent seismic activity (see Figure 4). Blizzards, fog, and torrential rains significantly reduce visibility and in some extreme blizzards, "white-out" conditions arise that reduce visibility to zero. Wind damage has included blown-down highway signs, turned-over campers, and blown-off roofs as well as blowing moving vehicles off ice-slick roads. Although the Cordova Coastal Management Plan states, "Cordova is situated to take maximum advantage of the climatic buffers that these immediate mountain ranges provide (wind and storm front impacts are minimized)", the gaps around the lake, previously described, appear to funnel the storms' fury and intensify or magnify the forces.

FLOODING

There is evidence, including historic photographs, that flooding has occurred on the lake where water has been over the City Airport runway in the early 1930's, in 1949, in September 1958, and again in August 1981 (See Figure 4.)

As stated in the Cordova Flood Insurance Study (USHUD, 1978):

"The principal flood problem in Cordova is caused by high water in Eyak Lake. The Eyak River, which drains Eyak Lake, does not have the capacity for peak flow and hence the lake level rises. The weir which was added does slightly increase the flooding problem. The weir will be submerged several feet during flood flows. During the August 1981 flood, water was estimated to be seven feet above the top of the weir (Fauell, 1982). Had the

weir not been installed, the flooding problem probably would have been reduced as the lake and Eyak River eroded towards prequake levels."

Streamflow from Scott Glacier changed pattern in July 1983, (USFS, 1983) resulting in a major portion of the waters of the Scott River exiting from the west side of the glacier's terminus rather than from the east side as they had previously. Now a major portion of the glacial waters from the Scott River combine with Ibeck Creek and cause this previously clearwater stream to become glacially turbid. Just below the Mile 7, C.R.H. bridge, Lydick Slough branches off from the main channel of Ibeck Creek and enters into Eyak River about 3 miles further downstream. Approximately two miles below the bridge, Lydick Slough flows to within about 250 feet of Eyak River, separated from it by a low, forested neck of land. Since Lydick Slough is now carrying some of the Scott River water and sediment, it's water level is above that of Eyak River, and it spills across the narrow neck of land into Eyak River. Finally, Lydick Slough merges with Eyak River about another mile downstream of the spillover.

There are several consequences of this streamflow change, but here we will deal with flooding assumptions. Raised water levels on Lydick Slough (in combination with Scott River water) have caused water to back up on Eyak River above the junction of the two streams resulting in some flooding of the Forest Service cabin and Lydick Slough Trail. Since the Scott River shift, more water must now flow into Eyak River below the lake and may cause a greater backwater effect for water trying to flow out of the lake than previous to the shift. This may increase the flooding potential around the lake.

Another Study, Feasibility Study - Eyak Lake Water Stabilization, (Lyon Associates, Inc., 1970) calculated flood flows, lake level elevations, and discharge capabilities of Eyak River. They described an example flood situation: "Due to the flow characteristics of Eyak River, the maximum river flow, when the lake level is at elevation 21,20' and at low tide, is calculated to be only 5100 c.f.s. (cubic feet per second). This is less than the 20 year storm flood flow (11,800 c.f.s.). This means that under present conditions, floods will occur in the Eyak Lake area because Eyak River cannot handle the storm flows from the Eyak Lake drainage area." This conclusion was drawn prior to the Scott River channel change so, in light of this new development, flooding problems around the lake may be intensified. See Table 1 showing peak discharges which were computed for Eyak Lake in the Cordova Flood Insurance Study (USHUD, 1978) using standard hydrologic and hydraulic study methods.

EYAK LAKE AMSA COOPERATIVE MANAGEMENT PLAN



Alaska Coastal Management Program
This project is part of the 1990-1991 Alaska Coastal Management Program. It is a cooperative effort between the Alaska Department of Natural Resources, the U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency. The project is funded by the U.S. Department of the Interior, Office of Biological Services, and the U.S. Environmental Protection Agency.

HAZARD AREA MAP

- Avalanche Area
- Landslide Area
- 100-Year Flood Boundary
- 500-Year Flood Boundary

Note: Flood information was obtained from the Flood Insurance Study—City of Cordova, Alaska, USFWS 1978



Figure 4

TABLE 1

SUMMARY OF DISCHARGES

Flooding Source and location	Drainage Area (sq miles)	Peak Discharges (cfs)			
		10-yr	50-yr	100-yr	500-yr
Eyak Lake at outlet	40.5	8,700	13,700	16,300	23,800
Power Creek USGS Gage No. 2160	20.5	5,200	8,700	10,600	16,500

In the Lyons Associates study, they indicated a possible method to eliminate the flood potential of the lake by installing a channel from the lake through Cordova to the Gulf of Alaska. In the transmittal letter for the study report is this summary statement, "During past floods, the water found its way out of the lake by an old channel through Cordova. This has been further blocked since then by the highway fill. The culverts installed under the highway at this point do not look adequate to handle the excess..." The USFS (1983) study of the Scott River channel changes makes the same recommendation as one of their alternative solutions to the flooding problem - provide an overspill outlet from Eyak Lake's West Arm into Odiak Slough and Orca Inlet (by digging a channel through the low bridge of land separating Eyak Lake and Odiak Slough or by placing culvert pipe through this section and burying it).

AVALANCHE

A large landslide and snow avalanche area occurs which presents a hazard along the Copper River Highway at approximately Mile 5. According to local residents, Martie Samuelson and Mary Ann Addington, in personal interviews, a large avalanche occurred in 1964 that covered the highway about 30 feet deep with avalanche debris and extended to and across the Mile 5 Cutoff Road burying it with about 6 feet of debris and knocking down several trees. The avalanche generated wind blew down two 6 to 8" diameter trees in a residence site on the lakeshore. Mary Ann was buried with her dog in that avalanche and Martie, a neighbor who was looking out his window at the time, watched the two trees blow down in his yard and then was part of the rescue crew that dug Mary Ann out of the avalanche debris. Another avalanche crossed the highway and ran out into the head of the Christian Center Beach Bay in 1969 or 1970 (See Figure 4.)

Many avalanche tracks are visible at elevations above the study area and could, in large storm years, break loose and reach the study area even though the ancient tracks are now forested and not very evident.

EARTHQUAKES

The Eyak Lake study area is located on a major fault zone and is

classified into seismic Zone 4 which designates the highest level of risk in the Uniform Building Code. This governs the design and planning of structures and is based on potential severity, frequency and damage from seismic activity. Seismic Zone 4 designates an area of potentially high severity of seismic activity, high frequency of occurrence and high potential damage due to ground shaking.

Earthquake hazards result from the effect of the earth's movements on man and his activities:

- 1) primary hazards - the immediate results from the earthquake itself
 - a) upthrusting or lifting of the crust
 - b) subsiding or dropping away of the crust
 - c) vibratory motion
- 2) secondary effects
 - a) movement of masses of earth and rock
 - b) landslides
 - c) soil failure (liquefaction)
 - d) seiches
 - e) fires

In an interview with John Rogers, project engineer for the Alaska Seismic Study, U.S. Geological Survey, The Cordova Times of 11/12/81 reported:

This area is of interest to seismologists because Cordova sits on the boundary between the Pacific plate and the North American plate. As the Pacific plate slides under the North American plate, a large amount of seismic activity occurs.

Cordova is located near the Yakataga gap, which is picked by seismologists as an area to have a large earthquake in the future within ten years or so.

The Yakataga gap covers the area between Cape Yakataga and Kayak Island. As the fault in that area has not broken in a long time, the pressure is increasing and eventually an earthquake will relieve pressure along the faultline.

The largest known event to affect the study area is the Prince William Sound earthquake which occurred in 1964. The magnitude of this event registered 8.5 on the Richter scale and its epicenter was located 67 miles northeast of Cordova. Surface rupture associated with this event resulted in 6 feet of vertical uplift and 40 feet of lateral displacement along the coast near Cordova. Compared to other communities affected by the earthquake, tectonic uplift did far more damage in Cordova than seismic vibration and waves combined. In spite of the violent ground shaking, sharp jares, surface ground waves, ground fissures, and differential

settling, it is significant that the Eyak River Bridge which has foundations on bedrock was not damaged (USGS, 542-G, 1964).

Stone and Webster (1982) reported: "There are many active faults in the study area, the largest system is the Contact fault located mid-way between Cordova and Valdez. Some of these faults have undergone significant displacements associated with seismic events during historic time."



Figure 5. Local major faults. (Source: TAMS, 1981).

All evidence points to the fact that there will be future earthquakes. Planning for development should consider the whys of past earthquake damage and move ahead accordingly.

OTHER HAZARDS

The tsunami, a tidal wave generated by sudden tectonic displacement, possibly could affect the study area depending on the intensity of the event, however, the likelihood of this happening would be rated as "extremely rare". Telesismic tsunami are earthquake generated while the local or seiche tsunami is generated by massive rock or earth slides either above or below water. A seiche can occur when enclosed or inland bodies of water are agitated to violent action caused by an earthquake, or by a landslide or avalanche which rapidly dumps large amounts of material into the body of water or by motion of its bottom. Eyak Lake is subject to seiche formation and its accompanying destruction.

Mass earth movement such as rock falls, landslides, and debris flows result from slope instability and are initiated in various ways including earthquake shaking and soil liquefaction. Local

examples are: 1) the Power Creek slides that dammed the valley above Ohman Falls and 2) the mountainside that shook loose and slid across Sherman Glacier during the 1964 earthquake. There is not sufficient data to predict the possibility of this massive wasting around Eyak Lake except that one area (the avalanche path at Mile 5 1/2 CRH) appears threatening. Talus rubble lays on top of bedrock on this over-steepened slope and the instability has been increased with the borrow removal of the toe of the slope. These conditions are likely to exist: 1) massive weight of material resting on steep bedrock, held to the bedrock by friction, and with the supporting base removed; 2) lubrication of interface between rock and talus by groundwater flow; 3) potential liquefaction of the unsupported mass; 4) potential seismic shock waves.

Two natural landslides occurred in 1982 in the vicinity of the study area: 1) about one mile upstream of the Mile 7, C.R.H. bridge on the mountainside leading down to the bank of Ibeck Creek, and 2) on Power Creek just below Ohman Falls bringing a large debris wedge down to the creek which has resulted in additional sediment load being carried to Eyak Lake (USFS, 1983).

CHAPTER TWO: SOILS

INTRODUCTION

This chapter contains soils and landforms information for the Eyak Lake study area prepared by Robert H. Heucker, Soil Scientist, Chugach National Forest, Anchorage, Alaska, 1981.

Much of the area consists of steep glacial sideslopes and ice scoured hills. The soils are shallow and there are many bedrock exposures and vertical rock walls, especially at the higher elevations. Except for the muskegs, avalanche areas, and landslides, these areas are forested. The rest of the area consists primarily of out wash plains which contain stratified soils and generally have a high water table and a high flood hazard. The higher, better drained areas are forested and the lower areas contain mostly alder, willow, sedges, rushes, and grass.

This survey was made by observing external features of the area on aerial photographs and drawing preliminary mapping unit boundaries based on such characteristics as tree canopy, slope, landform, and wetness problems. These preliminary boundaries were then checked and altered as necessary in the field. (Figure 6 shows the mapping units.) Soil properties and features of the landscape which have management implications were checked on each mapping unit, as much as possible, and limitation and suitability ratings were determined based on National Soils Handbook Notice 24 which provides definitions for the ratings and criteria for rating the soils.

Due to the very limited amount of time spent in the field gathering information, it was not possible to thoroughly study all of the mapping units and some of the ratings are based primarily on features of the land which could be observed from a distance such as slope gradient, avalanche and landslide areas, and drainage characteristics. Heavy rainfall during the time of the survey also caused flooding on much of Mapping Units 6 and 7 and this prevented access to some areas and made it impossible to observe some of the soils. Detailed soil descriptions were not made in any area, but sufficient information was gathered to rate the soils for the selected management activities. Most of the soils information was gathered from the lower elevations which generally are not as severely limited as the higher areas. The Soil and Water Resource Inventory of the Copper River Delta, prepared by Dean Davidson and Charles Harnish in 1978, provided additional information that was used in this chapter. Although there may be considerable variation in the soils at different locations on the same mapping unit, the ratings assigned to each unit should be a good reflection of the problems that can be expected.

MAPPING UNIT DESCRIPTIONS AND MANAGEMENT CONSIDERATIONS

The following descriptions summarize the soil properties

associated with each mapping unit. See Figure 6 for map of soil mapping units. They include a topographic description of each unit and major factors which limit development.

Mapping Unit 1

Area: 955 acres - 24.4 percent of total mapped area

Description: Mapping Unit 1 occurs on forested hills which have relatively short slope lengths. The slope gradient of the hillsides ranges from about 25 percent to steeper than 90 percent. Bedrock or a compact, nearly impermeable layer is frequently found near the surface which restricts drainage on the flat, benchy areas and causes water to seep down the hillsides at a shallow depth. The flat areas often have a high water table and show some mottling. Small streams are present and flow beneath the surface in some areas. Muskegs are common on the flat areas and they generally have narrow, and sometimes deep channels flowing through them.

The mineral soils have an organic mat that is 15.2 to 20.3 cm (6 to 8 inches) thick. Soil textures range from silt loam to sandy loam near the surface and the substratum is normally sandy and contains more than 40 percent gravel, cobbles, and stones by volume in varying mixtures. In depositional areas the soils are deep and contain a high amount of gravel and larger fragments. There are also isolated pockets that have a clayey texture. Most of the soils are moderately to well developed and are classified as Spodosols or Inceptisols.

The organic soils vary considerably in depth and generally become less decomposed with depth. The lower horizons are usually fibric. Thin layers of mineral soil are commonly found between organic horizons. The organic material is generally resting on a silt loam or sandy loam substratum which tends to be high in gravel, cobbles, and stones. The water table varies in depth and is at the surface in some areas and much deeper in others. These organic soils occur on slope gradients of up to 20 percent.

Management Considerations: The major limiting factors for Mapping Unit 1 are slope gradient, depth to bedrock, wetness, and organic soils. There are severe limitations for paths and trails on slope gradients greater than 25 percent and severe limitations for all of the other rated management activities on slope gradients steeper than 15 percent. Wetness is a problem on the muskegs and wherever there is a restricting layer that causes water to be held near the surface or to seep through the soil near the surface. The depth to bedrock causes moderate or severe limitations over much of the unit for shallow excavations and septic tank absorption fields, but there are many depositional areas, especially at lower elevations, where this is not a problem. The bedrock presents moderate limitations for dwellings without basements when it occurs between 50.8 and 101.6 cm. (20

EYAK LAKE AMSA COOPERATIVE MANAGEMENT PLAN



Alaska Coastal Management Program

The program is a cooperative effort between the State of Alaska and the U.S. Department of Commerce, Bureau of Ocean Management, to develop and implement a coastal management plan for the Eyak Lake area. The plan is based on the best available information and is subject to change as more information becomes available.

LOCATION OF SOIL MAPPING UNITS

NOTE: For Legend See Text

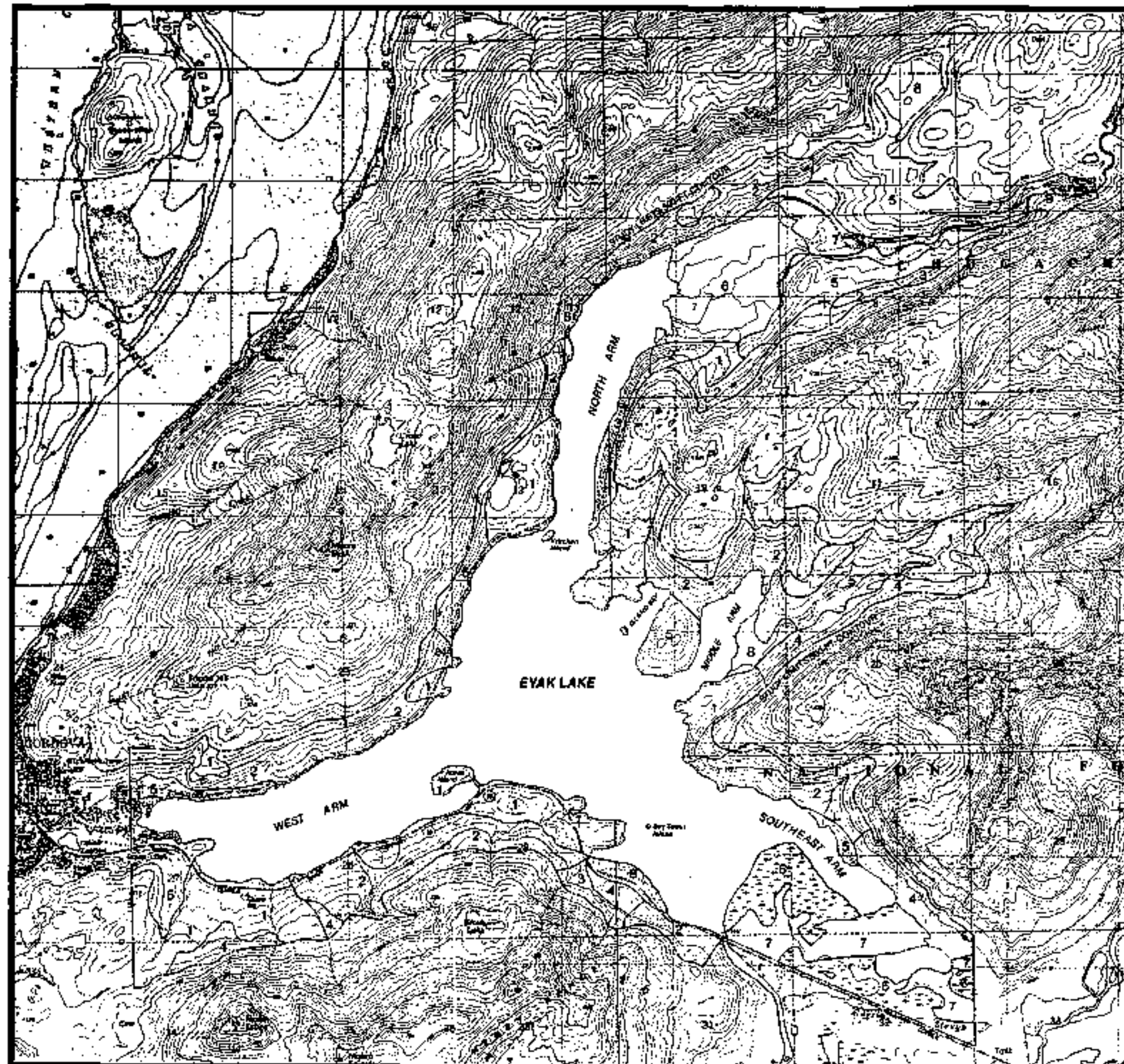


Figure 6

and 40 inches) of the surface, for septic tank absorption fields when it is between 101.6 and 182.9 cm. (40 and 72 inches) of the surface, and for the other activities when it is between 101.6 and 152.4 cm. (40 and 60 inches). The limitation is severe if the bedrock is deeper than these limits. Potential frost action moderately limits local roads on mineral soils. The muskegs have severe limitations for all of the rated management activities. Road and trail construction should be restricted on slopes steeper than 45 percent and avoided on slopes over 65 percent due to high erosion and landslide hazards. Most of Mapping Unit 1 provides an improbable source of sand or gravel either because suitable material is not present or the layers are too thin, although there are some suitable sites in the low elevation depositional area. The benches may provide a fair to poor source of roadfill material but are limited by the depth of the bedrock, slope gradient, and thickness of suitable material.

Mapping Unit 2

Area: 1037 acres = 26.4 percent of total mapped area

Description: Mapping Unit 2 occurs on long, steep, forested glacial sideslopes. The surface is frequently benchy and contains vertical rock faces, especially at the higher elevations. Numerous small streams are present and most are not deeply incised and are probably intermittent. Slope gradients range up to 120 percent or more in the high areas to less than 40 percent in the low areas. Some of the benches are nearly level. Bedrock outcrops, some of which are covered with moss, are common at the higher elevations. Few muskegs are present.

The soils are generally shallow except at the lower elevations and in small depositional areas at the higher elevations. The shallow soils generally have a silt loam to loamy texture and lack coarse fragments, but a few areas contain a coarse, compact layer of soil that impedes drainage. The soils at the lower elevations tend to be deeper than those that occur on Mapping Unit 1 and exhibit stratification in some areas indicating that the till has been reworked by water to some extent. The stratified layers are frequently compact and the gravel well fitted. During wet periods, water seeps downslope over the compact layers, resulting in wet conditions near the surface.

Management Considerations: The major limiting factors for Mapping Unit 2 are slope gradient, depth to bedrock, and wetness. The slope gradient causes severe limitations for all of the rated management activities on the steep sideslopes and slight to moderate limitations on the benches, depending on whether or not the slopes are steeper than 8 percent. The shallow depth to bedrock causes moderate or severe limitations for all of the rated management activities except for paths and trails, some of the low elevation depositional areas, and for campgrounds when the soils are deeper than 50.8 cm. (20 inches). All of the rated management activities have moderate or slight limitations due to wetness. At

some locations, it may be possible to reduce this limitation by constructing diversions around any planned management activities. The soils have moderate to severe limitations for local roads due to low strength and a potential frost action hazard. In areas where compact till is present on the sideslopes, it presents severe limitations for septic tank absorption fields and sanitary landfills. The ratings tend to be less severe on the low elevation depositional areas. Mapping Unit 2 provides a poor source of roadfill material primarily due to the steep slopes and shallow soil depth, although some of the low elevation depositional areas may be suitable. It provides an improbable source of either sand or gravel except in isolated pockets where the soils are stratified.

Mapping Unit 3

Area: 122 acres - 3.1 percent of total mapped area

Description: Mapping Unit 3 occurs on very steep glacial sideslopes. Rock slides are numerous and the surface is littered with talus and scree. The unit is forested except for the slide paths.

The soils are probably loamy in texture. They have a high coarse fragment content, especially along the slide paths, and are well mixed. Some areas consist almost entirely of angular rock fragments that have accumulated at the bottom of some of the slopes.

Management Considerations: Mapping Unit 3 has severe limitations for all of the rated management activities due to the steep slope gradients. It also has high or very high avalanche and landslide hazards and the soils would be unstable if the vegetation cover was removed. It is a poor source of roadfill material for the same reasons, plus it has too many large stones in the accessible areas. It has been rated as an improbable source of sand or gravel, although it does provide a source of larger rocks that could be crushed into gravel-sized fragments.

Mapping Unit 4

Area: 240 acres - 6.1 percent of total mapping area

Description: Mapping Unit 4 occurs on steep avalanche paths. The unit is similar to Mapping Unit 3 except that it is primarily non-forested, the slope gradients are somewhat less, and the soils do not have as many coarse fragments. The vegetation consists of alder and grass. Some trees are present along the edges, but they are susceptible to avalanche damage.

The soils generally have a loamy texture and are well mixed. Some areas may be wet due to water seeping down the slope near the surface over bedrock or a layer of compact till. The gravel and cobble content is high.

Management Considerations: Mapping Unit 4 has severe limitations for all of the rated management activities due to the steep slope gradients and the high avalanche hazard. It has been rated as a poor source of roadfill material because of the slope gradient, but the lower portion of the unit is not as steep and may provide a suitable source. Mapping Unit 4 is an improbable source of sand and a variable source of gravel that may be suitable in some and not in others.

Mapping Unit 5

Area: 654 acres = 16.7 percent of total mapped area

Description: Mapping Unit 5 is similar to Mapping Unit 1 but lacks the wet, organic soils. It contains a dense tree canopy and consists of small hills and benches. Slope lengths are relatively short. The slope gradients may be as steep as 100 percent on the sideslopes but generally is shallower. The hilltops and benches are gently sloping to flat. The surface is hummocky and there are few bedrock outcrops.

The soils are well developed on the sideslopes and relatively deep. Textures are loamy near the surface and become coarser with depth. Gravel and cobbles are present in only small amounts near the surface and increase to 30 to 40 percent with depth. The organic mat is about 12.7 cm. (5 in.) thick. The soils on the flat areas are not as well developed and tend to have a higher coarse fragment content. Isolated locations have a perched or seasonally high water table.

Management Considerations: The sideslopes of Mapping Unit 5 have severe limitations for all of the rated management activities due to the steep slope gradients. Depth to bedrock is also a limiting feature on the sideslopes for all but campgrounds and paths and trails. The benches and flat areas only have slight limitations for campgrounds, paths and trails, local roads, and dwellings without basements. Frost action and the isolated areas that have a high water table may be a problem for local roads at some locations. Depth to bedrock, in most areas and wetness result in moderate limitations for shadow excavations, septic tank absorption fields, and sanitary landfills. Mapping Unit 5 provides a poor source of roadfill material on the sideslopes due to the steep gradient and a fair source of material on the benches and flat areas, limited primarily by thickness and the amount of material available. The entire unit provides as improbable source of either sand or gravel.

Mapping Unit 6

Area: 480 acres = 12.2 percent of total mapped area

Description: Mapping Unit 6 occurs on non-forested outwash plains. It has a high water table and much of it is frequently flooded. The unit is poorly to very poorly drained except for

stream levees and localized areas along the margin. The lower areas generally have a vegetative cover of rushes and sedges. Somewhat higher sites contain willow, devil's club, and grass. Some spruce trees are found on higher better drained soils, especially along the margins of the unit. Slope gradients range from 0 to 5 percent and the topography is often hummocky. Many small ponds and streams are present.

The soils are deep and consist of stratified layers of sand, silt, and gravel. Some isolated pockets of organic soil are also present.

Management Considerations: Mapping Unit 6 has severe limitations for all of the rated management activities due to wetness problems and/or high flood hazard. It also provides a poor filter material for septic tank absorption fields and presents seepage problems for sanitary landfills which should be avoided on this unit. In general, this unit provides a poor source of roadfill material due to the high water table, but suitable locations can be found along the margins. Mapping Unit 6 provides a probable source of both sand and gravel, but field investigation would be necessary to locate suitable sites for the desired particle size.

Mapping Unit 7

Area: 262 acres = 6.7 percent of total mapped area

Description: Mapping Unit 7 occurs on outwash plains and is similar to Mapping Unit 6 except that it is forested and the water table is not as high in most places. The tree canopy is greater than 30 percent and there is a considerable amount of alder, willow, and devil's club. The area has a high flood hazard and low areas have a high water table. The slope gradient is generally less than 5 percent and the surface is hummocky and has many streams flowing through it.

The soils consist of stratified layers of sand, silt, and gravel. High areas have a very rapid permeability and are excessively drained and the lower areas are often poorly to very poorly drained.

Management Considerations: Mapping Unit 7 has only slight limitations for paths and trails. Where flooding or wetness is a problem, there are severe limitations for campgrounds and dwellings without basements and moderate limitations for local roads and shallow excavations. The soils present severe limitations for septic tank absorption fields because they are a poor filter material and for sanitary landfill due to seepage problem. Both of these rated uses have flooding and wetness problems in many areas. The soils provide a fair source of roadfill material and are a probable source of sand and gravel, although field investigation would be necessary to locate suitable sites for the desired particle size.

Mapping Unit 8

Area: 109 acres = 2.8 percent of total mapped area

Description: Mapping Unit 8 consists of alluvial fans. About 60 to 70 percent of this unit is forested with spruce and hemlock and the rest has a cover that is primarily alder, salmonberry, and devil's club. The nonforested portions of the fans generally have a high avalanche hazard. Small active and abandoned stream channels are common. Slope gradients typically range from 5 to 20 percent but may be steeper near the top at the apex.

The soils are depositional in nature and are generally well drained. Soil textures are variable from location to location and range from loam to coarse sand. Soil depths are greater than 100 cm. (39.4 in.). The percentage of gravel and cobbles by volume is high, but their relative proportions are variable. Either one may be present in amounts of 70 percent or more by volume. The coarse fragments are normally rounded.

Management Considerations: Due to the changing conditions that are found across this unit, the ratings for the selected management activities are highly variable. The following conditions are the limiting factors. The high avalanche hazard on the non-forested areas limit most uses for at least part of the year. Flooding in the vicinity of the active streams is also a problem, but this would not affect projects that can be located away from the streams. The slope gradient is a factor primarily on the upper part of the unit. The high amount of large or small stones also limits use, but on-site investigation would be necessary to determine which, if either, is a problem at a particular location. Layers of coarse-textured soil cause seepage problems for sanitary landfills and provide a poor filter material for septic tank absorption field over most of the unit. In general, Mapping Unit 8 provides a probable source of sand, but some suitable sources are probably available.

Mapping Unit 9

Area: 64 acres = 1.6 percent of total mapped area

Description: Mapping Unit 9 consists of non-forested river cut sideslopes. Vegetation is primarily alder, salmonberry, devil's club, and small forbs. The slopes are very steep and have a gradient of up to 75 percent or more. Bedrock is near the surface in some areas. The slopes are relatively stable, but some small slides are present and a considerable amount of erosion would occur if the vegetation was removed. Much of this mapping unit has a high avalanche hazard. The deeper soils probably contain a high amount of gravel and a lesser amount of cobble and are well drained. Soil textures range from loam to loamy sand.

Management Considerations: Mapping Unit 9 has severe limitation for all of the rated management activities. The major limiting

factor is the steep slope gradient. In addition to that, many potential uses are limited by the high avalanche hazard over most of the unit and by the shallow bedrock on part of the unit. Mapping Unit 9 is rated as an improbable source of either sand or gravel. Some of the deeper soils probably provide a suitable source of gravel, but access is limited. The unit provides a poor source of roadfill material due primarily to the steep slope gradients and access problems.

RATING SOILS FOR SELECTED USES

Soils are rated for the uses expected to be important or potentially important to users of this report (See Table 2). Ratings for proposed uses are given in terms of limitations and restrictive features or suitability and restrictive features. The definitions of the ratings are as follows.

Limitation Ratings

Soils are rated in their "natural" state; no unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use.

Slight (SL) - is the rating given soils that have properties favorable for the use. The degree of limitation is minor and can be overcome easily. Good performance and low maintenance can be expected.

Moderate (M) - is the rating given soils that have properties moderately favorable for the use. The degree of limitation can be overcome or modified by special planning, design, or maintenance during some part of the year, the expected performance of the structure or other planned use is somewhat less desirable than for soils rated "slight". Some soils rated "moderate" require treatment such as artificial drainage, control of runoff to reduce erosion, extended septic tank absorption fields, extra excavation, or some modification of certain features through manipulation of the soil. For these soils, modification is needed for those construction plans generally used for soils of slight limitation. Modification may include specially designed foundations, extra reinforcement of structures, sump pumps, and the like.

Severe (S) - is the rating given soils that have one or more properties unfavorable for the rated use, such as steep slopes, bedrock near the surface, flooding, high shrink-swell potential, a seasonal high water table, or low strength. This degree of limitation generally requires major soil reclamation, special design, or intensive maintenance. Some of these soils, however, can be improved by reducing or removing the soil feature that limits use, but in most situations, it is difficult and costly to alter the soil or to design a structure so as to compensate for a severe degree of limitation.

TABLE 2. SOIL RATINGS FOR SELECTED USES.

Soils	Orientation	Reference Development		Building Site Development			Sanitary Facilities		Construction Materials		
		Compromise	Field and Road	Local Roads	Public Excavations	Foundations without Basement	Septic Tank Absorption Pits	Sanitary Landfills	Fill	Gravel	
1	HT1000	S-1000 SI-M-bedrock	S-1000 M-bedrock	S-1000 M-bedrock action bedrock	S-1000 M-S-bedrock M-bedrock	S-1000 SI-M-bedrock bedrock	S-1000 M-S-bedrock bedrock	S-1000 M-S-bedrock bedrock	S-1000 F-1000 F-1000 S-1000 bedrock	Improvable	Improvable
	HT1000 and benches	SI-M-bedrock	M-bedrock	M-bedrock action bedrock	M-S-bedrock M-bedrock	SI-M-bedrock bedrock	SI-M-bedrock bedrock	SI-M-bedrock bedrock	F-1000 F-1000 S-1000 bedrock	Improvable	Improvable
	Benches	S-1000 SI-M-bedrock	S-1000 SI-M-bedrock	S-1000 SI-M-bedrock	S-1000 SI-M-bedrock	S-1000 SI-M-bedrock	S-1000 SI-M-bedrock	S-1000 SI-M-bedrock	S-1000 SI-M-bedrock	Improvable	Improvable
2	HT1000	S-1000 M-S-bedrock SI-S-bedrock	S-1000 M-S-bedrock	S-1000 M-S-bedrock rock bedrock action bedrock	S-1000 M-S-bedrock bedrock	S-1000 M-S-bedrock bedrock	S-1000 M-S-bedrock bedrock	S-1000 M-S-bedrock bedrock	S-1000 F-1000 F-1000 S-1000 bedrock	Improvable	Improvable
	Benches	M-S-bedrock SI-S-bedrock SI-M-bedrock	M-S-bedrock	M-S-bedrock rock bedrock action bedrock	M-S-bedrock bedrock	M-S-bedrock bedrock	M-S-bedrock bedrock	M-S-bedrock bedrock	F-1000 F-1000 S-1000 bedrock	Improvable	Improvable
	Benches	M-S-bedrock SI-S-bedrock SI-M-bedrock	M-S-bedrock	M-S-bedrock rock bedrock action bedrock	M-S-bedrock bedrock	M-S-bedrock bedrock	M-S-bedrock bedrock	M-S-bedrock bedrock	F-1000 F-1000 S-1000 bedrock	Improvable	Improvable
3	Entire Mapping Unit	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	Improvable	Improvable
4	Entire Mapping Unit	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	Improvable	Improvable
5	HT1000	S-1000	S-1000	S-1000 SI-M-bedrock rock action bedrock	S-1000 SI-S-bedrock	S-1000 SI-M-bedrock	S-1000 M-S-bedrock	S-1000 SI-S-bedrock	S-1000 F-1000 F-1000 S-1000 bedrock	Improvable	Improvable
	Benches and Fill areas	SI	SI	SI-M-bedrock rock action bedrock	M-bedrock bedrock	SI	M-bedrock bedrock	M-bedrock bedrock	F-1000 F-1000 S-1000 bedrock	Improvable	Improvable
	Benches	SI	SI	SI-M-bedrock rock action bedrock	M-bedrock bedrock	SI	M-bedrock bedrock	M-bedrock bedrock	F-1000 F-1000 S-1000 bedrock	Improvable	Improvable
6	Entire Mapping Unit	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	Improvable	Improvable
7	Entire Mapping Unit	S-1000	SI	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	Improvable	Improvable
8	Entire Mapping Unit	SI-S-1000 small stones filled	SI-M-1000 large stones	SI-S-1000 large stones large stones low strength bedrock	SI-S-1000 large stones large stones	SI-S-1000 large stones	SI-S-1000 large stones	SI-S-1000 large stones	SI-S-1000 large stones	Improvable	Improvable
	Benches	SI-S-1000 small stones filled	SI-M-1000 large stones	SI-S-1000 large stones large stones low strength bedrock	SI-S-1000 large stones large stones	SI-S-1000 large stones	SI-S-1000 large stones	SI-S-1000 large stones	SI-S-1000 large stones	Improvable	Improvable
	Benches	SI-S-1000 small stones filled	SI-M-1000 large stones	SI-S-1000 large stones large stones low strength bedrock	SI-S-1000 large stones large stones	SI-S-1000 large stones	SI-S-1000 large stones	SI-S-1000 large stones	SI-S-1000 large stones	Improvable	Improvable
9	Entire Mapping Unit	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	S-1000	Improvable	Improvable

Soil ratings
moderate

In rating soils for non-farm uses, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most degrees of limitations. Most of these practices, however, are costly. The manager must be willing to live with a few limitations, providing the use does not violate codes or regulations. The final decision in selecting a site for a particular use is a personal one and generally involves weighing the cost for site preparation and maintenance.

Suitability Ratings

Soils are rated in their "natural" state, that is, no unusual modifications of the soil site or materials are made other than that which is normal practice for the rated use.

Good (G) - means the soils have properties favorable for the use. Good performance and low maintenance can be expected.

Fair (F) - means the soil is moderately favorable for the use. One or more soil properties make these soils less desirable than these rated "good".

Poor (P) - means the soil has one or more properties unfavorable for the use. Overcoming the unfavorable property requires special design, extra maintenance, or costly alteration.

SELECTED USES

Recreational Development

Soils are rated according to limitations that affect their suitability for camp areas, picnic areas, and paths and trails. Not considered in this rating, but important in evaluating a site, are location, accessibility of the area, size and shape of the area, its scenic quality, the ability of the soil to support vegetation, access to water, availability of potential water impoundment sites, and either access to public service lines or the capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreational use by the duration of flooding and the season when it occurs. On-site assessment of duration and frequency of flooding is essential in planning recreational facilities.

Camp Areas are tracts of land used intensively for tents, trailers, and campers and the accompanying activities of outdoor living. Camp areas require such site preparation as shaping and leveling for tents and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The soils are rated on the basis of soil properties that influence the ease of developing camping areas and the performance of the camping area after development. Soil properties that influence trafficability and promote the growth of

vegetation after heavy use are important.

Slope, stoniness, and depth to bedrock or cemented pan are the main concerns in developing camp areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm to heavy foot traffic, and not be dusty when dry. Soil properties that influence trafficability are texture of the surface layer, wetness, permeability, and large stones. Slow permeability and clayey surface textures are not as severe a limitation to dry regions of the country; however, silty soils may be more of a problem because they are dusty.

Soil properties that influence the growth of plants are depth to bedrock or cemented pans, permeability, and the presence of toxic materials. Soils that flood are particularly hazardous for camp areas because of the danger to life and property.

Paths and trails are used for walking, horseback riding, and other uses and require little or no cutting or filling. The ratings are based on the properties that influence trafficability and erodibility. These are stoniness, wetness, texture of the surface layer, slope, flooding, erodibility, and in dry regions, dustiness.

Building Site Development

Soil properties influence development of building sites, including the selection of the site, the design of the structure, construction, and after construction, performance and maintenance.

Soil limitation ratings of slight, moderate, and severe are given for local roads and streets, shallow excavations, and dwellings without basements.

Local Roads and Streets - Limitation ratings are given for the use of soils for construction of improved local roads and streets that have all-weather surfacing (commonly of asphalt or concrete) and that are expected to carry automobile traffic all year. These roads and streets are graded to shed water and conventional drainage measures are provided. With the exception of a hard surface, the roads and streets are built mainly from the soil at hand. The properties that affect local roads and streets are those that influence the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or cemented pan, depth to water table, flooding, the amount of large stones, and slope. The properties that affect traffic-supporting capacity are soil strength, shrink-swell behavior, potential frost action, and depth to high water table. Soil slippage may be a problem on certain sloping soils.

Shallow Excavations - are trenches or holes dug in the soil to maximum depth of five or six feet. They are used for pipelines, sewerlines, telephone and power transmission lines, basements,

open ditches, grave sites, and the like. The excavations are most commonly made by trenching machines or backhoes.

The ratings are based on the soil properties that influence ease of digging and the resistance to sloughing. Depth and hardness of bedrock or cemented pan, the bulk density of the soil, and the amount of large stones influence the ease of digging, filling, and compacting. Depth to the seasonal high water table influence the resistance to sloughing.

Dwellings Without Basements - are buildings of three stories or less without basements. The foundation is assumed to be spread footings of reinforced concrete built on undisturbed soil at a depth of two feet or the depth of maximum frost penetration, whichever is deeper. The ratings are based on properties affecting soil strength and settlement under a load and those that affect excavation and settlement are the presence of a high water table and flooding and the shrink-swell behavior and compressibility of the soils. Compressibility is inferred from the Unified Classification System. Properties influencing the ease and amount of excavation are flooding, high water table, slope, depth to bedrock or cement pan, and the amount of coarse fragment.

Sanitary Facilities

The nature of the soil is important in selecting sites for septic tank absorption fields and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Those soil properties that determine the ease of excavation or installation of these facilities will also affect the ratings.

Soil limitation ratings of slight, moderate, or severe are given for septic tank absorption fields.

Septic Tank Absorption Fields - are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. The centerline depth of the tile is assumed to be at a depth of 24 inches. Only the soil between depths of 24 and 72 inches is considered in making the ratings. The soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction of the system, and those that may affect public health.

Properties and features that affect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, cemented pan, or ice, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock, ice, or cemented pan interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils. Some soils are underlain

by loose sand and gravel or fractured bedrock at a depth of less than four feet below the distribution lines. In these soils, the absorption field may not adequately filter the effluent, and as a result, ground water supplies in the area may be contaminated.

Percolation tests are used by some regulatory agencies to evaluate the soil's suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at a minimum absorptive capacity. The percolation rates do not correspond to the permeability rates because they are measured by different methods. Experience indicates that soils having percolation rates (1) faster than 45 minutes per inch function satisfactorily, (2) between 45 and 60 minutes per inch have moderate limitations, and (3) slower than 60 minutes per inch have severe limitations. In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.

Sanitary Landfills (Trench) - Sanitary landfill is a method of disposing of solid waste by placing refuse in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least two feet thick is placed over the landfill.

Ratings are based on properties to a depth normally observed during soil mapping. However, because trenches may be as deep as 15 feet or more, geologic investigations are needed to determine the potential for pollution of ground water as well as to determine the design needed. These investigations, generally arranged for by the landfill developer, include examinations of stratification, rock formations, and geologic conditions that might lead to the conducting of leachates to aquifers, wells, water courses, and other water sources. The presence of hard, non-ripple bedrock, creviced bedrock, or highly permeable strata in or immediately underlying the proposed trench bottom is undesirable from the standpoint of excavation and potential pollution of underground water. Properties that influence risk of pollution, ease of excavation, trafficability, and revegetation are major considerations. Soils that flood or have a water table within the depth of excavation present a potential pollution hazard and cause difficulty in excavating.

Soil slope is an important consideration because it affects the work involved in road construction, the performance of roads, and the control of surface water around the landfill. Soil slope may also cause difficulty in construction of the trenches where the trench bottoms must be kept level and oriented to follow the contour.

The ease with which the trench is dug and with which a soil can be used as daily and final cover is based largely on texture and

consistence of the soil. The texture and consistence of a soil determine the degree of workability of the soil both when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact, and to place in a uniformly thick cover over a layer of refuse.

The upper most part of the final cover should be soil material that is favorable for the growth of plants. It should not contain excess sodium or salt and should not be too acid. In comparison with other horizons, the A horizon in most soils has the best workability and highest content of organic matter. Thus, for a trench-type landfill operation, it may be desirable to stockpile the surface layer for use in final blanketing of the fill.

Construction Material

Suitability ratings of good, fair, or poor are given for soils used as a source of roadfill. Ratings of probable and improbable means that the source material is unlikely to occur within or below the soil. This rating does not consider the quality of the source material, because quality depends on how the source material will be used.

Roadfill - consists of soil material that is excavated from its original position and used in road embankments elsewhere. The evaluation for roadfill are for low embankments generally less than six feet and are less exacting in design than high embankments such as used in super highways. The rating is given for the whole soil, from the surface to a depth of about five feet, based on the assumption that soil horizons will be mixed in loading, dumping, and spreading. Soils are rated as to the amount of material available for excavation, the ease of excavation, and how well the material performs after it is in place.

Soil properties that affect the amount of material available for excavation are thickness of suitable material above bedrock or other material that is not as suitable. The percent of coarse fraction greater than three inches, depth to high water table, and slope are properties that influence the ease of excavation. Some damage to the borrow area is expected, but if revegetation and erosion control could become serious problems, the soil is rated severe.

Sand - as a construction material is usually defined as the size of particles ranging from .074 mm to 4.75 mm in diameter. Specifications for each purpose vary widely. The intent of this rating is to show only the probability of finding material in suitable quantity. The suitability of the sand for specific purposes is not evaluated.

The properties used to evaluate the soil as a probable source for sand are the grain size, the thickness of the sand layer, and the amount of rock fragments in the soil material.

If the lowest layer of the soil contains sand, the soil is rated as a probable source regardless of thickness. The assumption is that the sand layer below the depth of observation exceeds the minimum thickness.

Gravel - as a construction material is defined as the size of particles ranging from 4.75 mm to 76 mm (3 in) in diameter. Gravel is used in great quantities in many kinds of construction. Specifications for each purpose vary widely. The intent of this rating is to show only the probability of finding material in suitable quantity. The suitability of the gravel for specific purposes is not evaluated.

The properties used to evaluate the soil as a probable source for gravel are particle size, the thickness of the gravel layer, and the amount of rock fragments in the soil material. If the lowest layer of the soil contains gravel, the soil is rated as a probable source regardless of thickness. The assumption is that the gravel layer below the depth of observation exceeds the minimum thickness.

GLOSSARY

Coarse Fragments

Rock or mineral fragments having a diameter of 2 mm to 25.4 cm (10 in); gravel and cobbles.

Cobbles

Rounded or partly rounded fragments of rock having a diameter of 7.6 to 25.4 cm (3-10 in).

Fabric Material

The least decomposed of all organic soil material. Fabric peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin.

Gravel

As used in the text, rounded or angular fragments of rock between 2 mm and 7.6 cm (3 in) in diameter; as used in Table 2 for construction material, rounded or angular fragments of rock between 4.75 mm and 7.7 cm (3 in) in diameter.

Mottles

Spots or blotches of a different color; mottling in soils usually indicates poor aeration and lack of good drainage.

Muskegs

A common name applied to meadows of the generally timbered country which have very poorly drained organic soils derived from a sphagnum, sedge, grass, and/or herbaceous mat.

Outwash Plains

An extensive lowland area of mainly sandy or coarse textured glacial outwash deposited by meltwater streams beyond the active glacial ice.

Perched Water Table

A water table above an impermeable bed underlain by unsaturated material of sufficient permeability to allow movement of ground water.

Permeability

The ease with which water passes through a layer of soil.

Sand

As used in the text, a soil separate consisting of particles between 0.05 and 2.0 mm in diameter; as used in table 2 for construction material, a soil separate consisting of particles between 0.074 and 4.76 mm in diameter.

Scree

A heap of rock waste at the base of a cliff or a sheet of coarse debris mantling a mountain slope.

Stones

Rock fragments 25.4 to 61.0 cm (10 to 24 in) in diameter.

Stratified

Arranged in or composed of layers or strata of geologic material.

Substratum

The part of the soil below which the processes of soil formation are active.

Talus

A collection of fallen disintegrated material which has formed a slope at the foot of a steeper declivity.

Till

Unsorted and unstratified glacial drift, generally unconsolidated, deposited directly by a glacier.

Water Table

The upper limit of the soil or underlying rock material that is wholly saturated with water.

CHAPTER THREE: WATER QUALITY

There is a close relationship between upland use and water quality. The severity of impact is almost totally related to the intensity of development where commercial, industrial, and multi-family land uses have a much greater impact on water quality than single-family or low density single-family land uses. Water quality problems arise from both point and non-point sources. Point source is a waste discharge entering a water course at a single point, usually a pipe as in the case of outfalls from sewage treatment, whereas non-point source is refuse, entering a water body at many points, either from the land surface directly or through the ground water regime (an example might be human waste runoff and leaching from unimproved campsites). Eyak Lake is a shallow body of fresh water. The small overall volume of fresh water in the lake when compared to the large surface area makes Eyak Lake especially susceptible to point and non-point source pollution.

Sewage and hazardous wastes from upland sites is being discharged into the lake both from point and non-point sources. Pollutants loading would suggest that runoff is entering the lake carrying with it pollutants from the residential streets and yards, as well as grease, oils, and heavy metals from the various commercial enterprises around the lake, and from the power plant and road oiling. Circulation or flushing determines the localized impact of the contaminants in the water - the dispersion of the wastes or their distribution. Suspended sediment is generally a detrimental and serious pollutant and it is transported and circulated in the lake.

Water quality monitoring by ADEC (see Appendix D for water sampling data) revealed presence of heavy metals, specifically manganese, cadmium, lead, and iron, in significant concentrations to cause concern. According to EPA (USEPA, 1978), the chemical contaminants of heavy metals can cause health problems varying from minor irritations to traumatic death.

Manganese was present at a higher level than EPA recommendations for drinking water (USEPA, 1976) at one-fourth of the sample stations (2, 6, 7, 8, and 10) (see Figure 7 for sampling station locations) which were primarily at the tip of the West Arm.

Lead was detected at a level slightly higher than EPA recommendations at one of the 20 sampling stations (4) which happens to be just offshore of one of the air taxi operations bases. Road oiling runoff is a likely source of the lead as one study (USEPA, 1972) found that waste crankcase oil contains approximately 1% by weight of lead compounds.

Cadmium was found to exceed recommended concentrations for aquatic life (salmonids and cladoceraus) at three stations (2, 4, and 16) although the lower limit of quantification for cadmium (0.0001 mg/l) was well above the EPA maximum priority pollutant

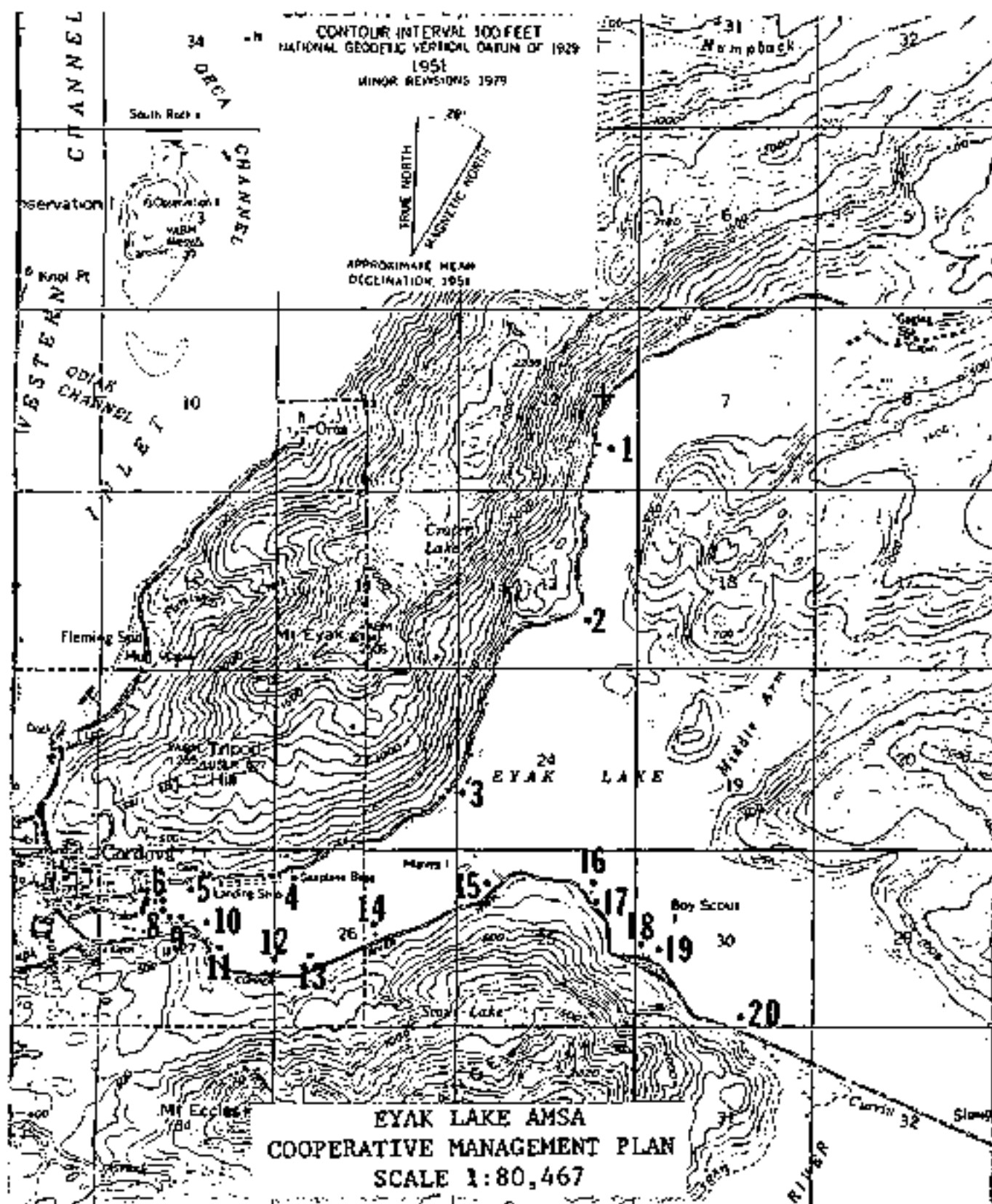


Figure 7. Alaska Department of Environmental Conservation water sample site locations, 1-20.

concentration (0.0004) for aquatic life. Cadmium is extremely harmful in various concentration levels in water as it is toxic to most aquatic organisms studied and its toxicity is accumulative (Canada Fisheries & Environment, 1977). Of some species of fish that were tested, Salmonids appear to be the most sensitive to low levels of cadmium in water (USEPA, 1978). "Cadmium accumulation and its toxicity - acute and chronic - to aquatic life generates concern, for all levels of the food chain are affected" (Canada Fisheries & Environment, 1977).

Cadmium is used as an alloy in bearings, in the manufacture of motor oils and tires to name a few possible sources for the contamination in lake waters (Canada Fisheries & Environment, 1977). One study (Hassel et. al., 1980) determined that highway traffic (lead from gasoline engine exhaust and cadmium from tires) correlated highly with the concentration of heavy metals in adjacent stream sediments and these stream sediments appear to serve as the storage reservoir and primary source for bioconcentration of heavy metals. (Several of the aforementioned studies indicate the need for investigation of community dynamics to more directly assay the threat to aquatic ecosystems posed by heavy metal contamination.)

Iron was found to be above EPA recommendations at three sample stations (2, 8, and 20) although not at dangerous levels.

Arsenic, barium, chromium, mercury, selenium, and silver were also examined and found to not indicate a level of concern or were not detectable at the limit of quantification.

There is evidence of fecal contamination in nearly all peripheral inhabited areas of the lake (ADEC). The presence of fecal coliforms in water is a good indication that fecal material and possibly disease germs may also be present. The higher the coliform count, the greater the danger in untreated water. Fecal coliform were found at each of the twenty sample sites ranging to a high of 245 f.c./100 ml.. Alaska water quality regulations allow up to 20 f.c. /100 ml. based on a minimum of 5 samples taken in a period of 30 day for both drinking water, seafood processors and contact recreation (swimming, etc.). The relative high concentrations of f.c. near the residential areas of the lake suggests the possibility of inadequate sewage treatment and/or direct discharge of sewage into the lake. Dye studies at selected residential sites along the lakeshore have indicated inadequate sewage treatment, contributing to the f.c. concentrations in the lake. Three sites have been located where direct discharge of raw and/or septic tank effluent is occurring. Five sewage treatment/disposal systems were found within 100 feet (minimum separation distance, State requirement) of the lake, and more systems are suspected.

Fish damage from the effects of sewage effluents have been attributed to several causes depending on which author you read--introduction of poisonous compounds, the decrease of the

dissolved oxygen as the result of bacterial decomposition and algal bloom, the increase of turbidity of water by suspended materials, the covering of fish food and spawning ground by deposited solid matter, the encouragement of fungus development, the shift in the biological balance in the waters, the increase of the incidence in fish diseases, and the production of tastes and odor in fish flesh (Tsai, 1975). One thing common to most of the reports, though, is the fact that sewage effluents do upset the natural regime of the water they enter.

Soil conditions adjacent to the lake appear to allow rapid water transport through the soil structure. Precipitation data for the Cordova area was collected over the sampling period to determine if a correlation existed between high rainfall and high f.c. count. There is the possibility that the soil conditions near the lake allow the rainfall to move rapidly through the sewage absorption systems carrying pollutants, not yet purified by the percolation properties of the soil, to the lake.

The soil ratings for septic tank absorption fields are "severe" or "moderate to severe" for most of the AMSA with a few exceptions where the ratings are "slight" or "moderate" (see Table 2). The exceptions are hilltops and benches in Unit 1, benches in Unit 2, benches and flat areas in Unit 5, and most sites in Unit 8. Percolation tests can be made to evaluate individual sites.

The State's water quality regulations applying to bodies of water (rivers, streams, lakes) were very general prior to 1969. Simply stated, no waste disposal system was allowed to contaminate the waters of the State in a manner which might cause a public health hazard. The minimum horizontal separation distances that were specified in the 1959 regulations (50 feet) were changed in 1969 to require greater separation distance (100 feet) between a water supply and any sewage disposal system. However, the 1959 and 1969 regulations remained unchanged regarding contamination of water supplies in that no one could cause the pollution of a groundwater supply by disposal of sewage or other hazardous material(s). Regulation changes in April, 1973, set a minimum 40,000 sq. ft. (0.9 acre) lot size for on-lot wastewater disposal where an on-lot water supply existed. In October of the same year, a 100 foot minimum horizontal separation distance was required between a lake, stream, river or coastal waters and a septic tank, soil absorption system or privy. Additionally, minimum vertical separation distance was established between the soil absorption system and the highest seasonable watertable elevation (4 foot minimum). The purpose of the minimum horizontal and vertical separation distances is to provide purification and ultimate disposal of septic tank effluent. The degree of the purification is primarily dependent on the soil type, loading rates and travel distance before entering the watertable. There is no background water quality data to indicate if the lake water is deteriorating and, if so, at what rate. The data generated by ADEC sample collection/analysis, dye study and on-site investigation indicates that contamination does exist and that the probability of an

increase in contamination is of concern.

As the Cordova area developed the people constructed whatever was necessary to sustain their activities. There have been on-lot sewage and water systems installed prior to 1980 that did not receive on-site inspections by local or state agency personnel. As a rule, systems installed prior to 1980 were approved if the owner/installer verbally stated to ADEC that the system met all requirements for on-site water supply and wastewater disposal systems. Where systems were in the ground and covered, inspections of sewage disposal systems were meaningless because proper construction could not be verified. Nevertheless, this was standard procedure and numerous systems were installed illegally, not according to State requirements. In no case are these illegally installed systems acceptable today. Any system that was installed illegally must be upgraded to meet state codes. There are no "grandfather" rights inherent in these systems regardless of their prior "approval". It is important that this aspect of existing systems is understood. The discharge of waste into a watertable and the resulting contamination of drinking water supplies can not be compromised. The options for limiting contamination to the lake from human fecal contamination include: 1) installation of holding tanks on lots too small for septic tank/leachfield application 2) upgrading failing on-lot systems to meet current disposal regulations 3) providing a collection and treatment system.

At the present time, the holding tank concept is currently not feasible as there is no holding tank pumping service in Cordova capable of handling this quantity of waste disposal. (Currently one 300-gallon pumper tank is in use in Cordova. A family of four people produces about 75 gallons/person/day, or over 2,000 gallons/week. This would require 7 trips to empty a single 2,000 gallon tank each week. Five homes, currently violating separation distance requirements, necessitates 35 trips/week.) The City has indicated that this steady dumping of concentrated sewage to the existing city sewage treatment plant would require modifications of operations to meet current EPA-NPDES permit restrictions. Pumping costs are an additional burden to the homeowner and can be considerable in some cases (large families). This should only be considered a temporary measure and not a long term solution.

Upgrading existing systems might suffice in cases where lot sizes and separation distances can be met and where groundwater requirements are not jeopardized. However, where lots are unable to conform to sizing requirements, the conventional septic tank or aeration chamber system will still not meet State codes and are therefore unacceptable installations. A treatment method currently under study includes a secondary treatment system followed by a sand filter, then discharge. It may be possible that this system could be installed within the 100 foot minimum separation distance (distance to be determined by soils investigation, ground slope, etc.). Secondary treatment followed by chlorination of effluent and direct discharge to land or water

is allowable in many situations. However, where anadromous fish are present, even trace concentrations of chlorine are devastating to the fry, and these systems are not acceptable. Thus, a secondary treatment system followed by sand filtration is a potential treatment scheme for small lots near Eyak Lake.

A conceptual agreement has been reached between the DOT/PF and property owners along the Copper River Highway for encroachment into the highway right-of-way to allow for construction of leach fields on lots which are too small to meet the 100 foot minimum horizontal separation distance from the lake. This will allow for an interim solution to upgrade failing systems until a more long term solution is available. An accurate count and analysis of each lot and treatment system would indicate the extent of this potential problem. The ultimate solution might be to extend the city sewage collection system to a point which best serves to eliminate the lake's human influences contamination.

Water quality impacts can be minimized through exercising the best management practices and enforcing State regulations and statutes for sewage treatment and disposal. Where violations of the State's water quality and/or wastewater regulations are found to occur in the Eyak Lake area, ADEC will assist the public to correct any deficiencies. If necessary, ADEC will follow a consistent enforcement policy toward good management practices. On-going water quality monitoring will provide a means of knowing the status of lake water quality and allow management decisions based upon analytical data rather than speculation.

On-going monitoring for fecal coliform is recommended with a minimum sampling schedule of twice yearly--during the spring thaw and in fall prior to lake freeze-up.

Sewage discharge with the resultant fecal coliform pollution cannot be tolerated in Eyak Lake as it diminishes its usefulness as a potable water source, a place for contact recreation, and potential threat to the fishery resource (increased BOD therefore reduces overwinter carrying capacity). As soon as possible after the adoption of this plan, it is recommended that DEC complete an inspection of all private septic systems with a followup listing requirements for those systems not in compliance and time constraints on the requirements.

Soil conditions, heavy annual precipitation, and past development practices, singly or in combination, are not conducive to leach field septic systems; and since there have been problems with drinking water pollution at residences in and adjacent to the AMSA; and since land use density can be increased in this area of demand that exceeds supply; it is recommended that the City of Cordova, DCRA, DEC, and DBSS conduct a joint feasibility study and public awareness program during PY 1985 to determine the feasibility, construction costs, and economic cost/benefit of a sewer and water system extension along the Copper River Highway from the present terminus of the City of Cordova water and sewer

systems to approximately Mile 7 CRH to serve all adjacent properties. In addition, similar extensions should be formed to serve the properties adjacent to the City field. An additional side benefit to a water supply and hydrant system would be reduced insurance premiums and better fire protection to those properties served. As an example, all residences outside the city limits are in Class 10, but could be classed in Class 8 if served by a hydrant system. On a new \$70,000 home the insurance premiums would drop from \$606 a year to \$340. Similarly, an older \$50,000 home would be insured at a cost of \$800 per year as Class 10, but only \$447 if in Class 8.

SEDIMENTATION AND TURBIDITY

Glacially fed Power Creek carries a relatively high concentration of suspended sediment and bed load. Stone and Webster (1982) predicted an average amount of sediment per year of between 3500 and 5400 tons. During high stream flow years the amount trapped could be as high as two or three times that estimate. The sediment has been assumed to be comprised of 10 percent clay, 33 percent silt, and 57 percent sand. This composition has a weight of 81 lbs/cu. ft. Based on this density, 3200 to 5000 cu. yds. of sediment per year would collect in the reservoir should a dam be built at Ohman Falls.

It is assumed that this sediment (or most of it) reaches the lake, however, it is not known how much passes through the lake and over the weir as suspended load. Prior to glacial melting each summer, the North Arm water is relatively clear. Once glacier melting begins, Power Creek carries suspended glacial flour into the North Arm, through the central body of the lake and over the weir. West Arm, Island Bay, and Middle Arm remain relatively clear of the turbidity except during lengthy storm periods. Life expectancy of the lake due to infilling could possibly be estimated through core sampling and analysis of the lake bottom.

The general turbidity pattern may influence aquatic vegetation growth, species composition, and associated biota as well as the biotic production of the ecosystem (ADF&G, 1983).

Further recommendations related to water quality are in order. Continued monitoring of the lake water by DEC is necessary to develop trend data on DO and BOD and to track the relationship between fecal coliform and the control measures described above. In addition, since heavy metals can have disastrous effects on zooplankton that travel up the food chain, sampling for heavy metals must be continued as well as phytoplankton sampling initiated at the earliest feasible date. With ADF&G currently doing phytoplankton sampling in the area it would be a simple process for that agency to add Eyak Lake to its sampling locations. This is especially important to ADF&G since the tie in with the fishery resource is quite apparent. Because of ground water pollution potential as well as surface runoff it is recommended that no solid waste disposal site be located in the

AMSA. The importance of this can not be overemphasized as there has been a recent proposal (by the City of Cordova to the Eyak Corporation) to create a site at Mile 7, CRH which would threaten the wetland habitat with pollutants.

The ground and surface waters of the study areas are subject to chronic, long term oil pollution (petroleum hydrocarbons) that comes from such sources as road oiling runoff, aircraft fuel sump draining and refueling spills, home heating fuel spill runoff, the ever present outboard motor fuel discharge, and the simple drippings that leak from all internal combustion engines. In the case of road oiling for dust control, an EPA study in New Jersey (EPA, 1972) concluded that: 1) roughly 1% of the total oil conservatively estimated to have been applied to the test roads remains in the top inch of road surface with minimal penetration below this top inch; 2) oil leaves the road during wet weather by floatation from wet road surface material and by floatation of oil-wet road surface particles; 3) lead, which is contained in the waste crankcase oil, also leaves the road surface with runoff. This same study found that waste crankcase oil contained approximately 1% by weight of lead and that it was ineffective as a road oil since it ran off rapidly following rains. In 1974, Alaska began controlling surface oiling in the state through a permit process and because of concern of water pollution, prohibited the use of waste oil for surface oiling in all of rain-drenched southeastern Alaska except for Haines and Skagway (Environmental Services, Ltd., 1979). Rainfall in the Cordova area is quite similar to southeastern Alaska and presents the same kind of runoff potential. According to DOT/PF representatives, a total of about 7000 gallons of waste oil is applied to Cordova roads in an average year and prior to the Cordova Electric Cooperative's generating plant recycling system, an additional 12,000 gallons of waste oil was used for road oiling from that facility (Environmental Services, Ltd., 1982). According to a NOAA technical report (NOAA, 1977) the most toxic fuel is probably gasoline because of its high content of aromatics and other low-boiling hydrocarbons which are relatively highly soluble in water. Weathering removes much of the more volatile, toxic fractions so that newly spilled fuels are more toxic than weathered oil.

Although it is not clear what the long-term effects of chronic oil pollution on aquatic life will be, the conservative approach would advocate stringent limitations on oil discharges until more information becomes available regarding effects on the ecosystem.

In order to stop the indiscriminate dumping of waste oil especially in the vicinity of the air taxi operations, aircraft service facilities, and the automotive repair shop in City Field, the lessors of those properties (DOT/PF and City of Cordova) shall establish a lease requirement for on-site storage of the waste oils. DEC shall furnish recommendations for suitable storage containers and other applicable requirements. It follows then that the City of Cordova is obligated to develop ways and means of

collection and disposal of the petroleum wastes. Use of the material as a fuel or for re-refining are possibilities. Although outside the scope of this study, indiscriminate dumping of waste oil is a widespread problem in and around Cordova and the only way to obtain some control is to provide a collection facility that is available to all residents. The problem is not simple as many other substances besides waste oil - solvents, paint thinners, etc. - require proper disposal, but complicate the problem.

Road oiling for dust control is probably the greatest detriment to Eyak Lake water quality as the high rainfall flushes the oil and its toxic pollutants into the lake and adjacent streams. Other dust control measures are available such as road surfacing or spreading water. It is recommended that DEC no longer issue permits for surface oiling anywhere in the Eyak Lake AMSA.

Fuel sump draining directly into the lake from floatplanes is a long-time practice, the extent of which has not been calculated. Land based planes at City Field are also guilty except that the fuel is drained onto the ground and what doesn't dissipate into the air eventually finds its way into the lake. Aircraft operators should be required to collect their drained fuel and maintain suitable containers for temporary storage of the drained fuel.

Recent testing of outboard motor pollution done under the auspices of EPA revealed preliminary findings that outboard motors do not pollute. As testing continues, however, we can assume that outboard use is not a threat to water quality at this time.

It is common knowledge that a significantly large oil spill or leak has occurred in the vicinity of the power house at the western tip of the lake and has resulted in oil to seep into the lake. Oil will bubble to the surface when the lake bottom is disturbed in the vicinity of the Spit at Nirvana Park and is an apparent indication of the problem. Long detention times of these pollutants may magnify their impacts during periods when the lake is ice covered, inflows and outflows are minimal and the water quiescent. Dispersion and distribution of wastes determines the local impact of contaminants in the water. This is controlled by circulation patterns and rate of flushing in the lake.

Since the power plant has long been suspected as a source of waste oil and diesel spill pollution into lake waters, this plan recommends DEC and the Cordova Electric Cooperative to conduct a joint study to determine the extent of this problem, if any, and outline the steps necessary to alleviate it either directly or through mitigating measures.

Power Creek, being glacially fed and moving through an eroding stream channel with mass wasting from steep adjacent slopes and avalanche debris adding to the problem, carries a considerable sediment load. A conservative estimate of the total annual sediment load in Power Creek is 4.1 to 6.1 acre feet. One

prediction showed the average amount of suspended sediment per year to be between 3500 and 5400 tons with that amount doubled or tripled during high stream flow years (Stone and Webster, 1982).

Being fed primarily by Power Creek, Eyak Lake acts as a settling basin, and, surprisingly, many parts of the lake remain quite clear even though the incoming flow from Power Creek is turbid. On the other hand, the runoff that occurs in the Murchison Falls Creek drainage basin is almost void of soil erosion problems and remains quite clear even during high runoff periods. This helps make Murchison Falls Creek an "excellent raw water source" for drinking water. (Merrell et al., 1980).

Previous water quality data for Eyak Lake also indicated that the water quality was poorest in the most westerly end of the lake and that the poorer quality was attributable to pollution resulting from the residential development adjacent to the lake. Since that time, a wastewater collection and treatment system has been installed in Cordova and the most likely potential causes of the pollution (septic tank leach systems) in the west end of the lake have been removed by connection to the sewer system (Merrell et al., 1980).

Sediment pollution has detrimental effects on aquatic life and is caused by both natural events and man's activities and we see examples of both in Eyak Lake--glacial silt from Power Creek basin and sediment runoff from construction activities on the uplands, as examples. Sediment deposited in spawning gravels hampers survival of fish eggs, alevin and fry; decreases the permeability of gravel substrates used for spawning; and may inhibit production of aquatic plants and invertebrate fauna thus reducing the food available to rearing and resident fish. Sediment is a natural phenomenon and occurs in generally predictable seasonal cycles of clear and turbid waters. During the water period of the year, runoff and clear and turbid waters. During the warm period of the year, runoff and glacial melt increase. Aquatic communities have developed in rhythm with the turbid-clear cycle (ADP&G, 1983).

It is important to get some more detailed information regarding phosphorous concentrations throughout the lake. It would be of value to analyze some selected sediments for total phosphorous. This information in conjunction with a measure of the primary productivity of the lake and the members of the phytoplanktonic community would be invaluable in determining the current trophic status of the lake.

High DO (dissolved oxygen) and low BOD (biochemical oxygen demand) were found in a year even when the lake was ice covered for many months. This is a good condition for overwintering of fish. Apparently the decaying plants were not a problem either in terms of oxygen under the above conditions. Heavy snow cover may reverse the conditions and in severe winters, low DO and high BOD may limit fish survival and productivity.

An important relationship that is not known at this time is that between phytoplankton, zooplankton, and the opacity of the water, and the photosynthesis process in the various regions of the lake. We need to understand their composition, population structure, phenology and contribution to the ecosystem. A connected relationship is that between the water opacity and sunlight penetration as it affects plant growth and water column heating.

Because of the lessened severity of impact on water quality, single-family and low density single-family land uses are recommended within the AMSA.

The water treatment plant is a potential pollution source because of the use of chemicals (notably chlorine) and back-flushing to clear the filters. ADEC should assist the City to develop a set of required procedures for the plant to reduce the potential for lake pollution.

Core sampling of the lake bottom should be done to obtain detailed information regarding phosphorus concentrations. Information on total phosphorus measured in conjunction with the primary productivity and phytoplankton community would be valuable in determining the current trophic status of the lake.

CHAPTER FOUR: BIRDS AND MAMMALS

Thirty-one mammal species have been recorded in the study area from the small shrews and voles to brown bear and moose.

One hundred thirty-nine species of birds have been recorded on or over the Eyak Lake study area. The area's close proximity to marine habitats and major bird migration routes contributes to the large number of species. Twenty-nine species are known to breed within the study area while twenty additional species are listed as "probable" breeders. Twenty-four other species are "suspected" breeders in the area.

The objectives of this chapter are:

- (1) to describe the habitats available and utilized by birds and mammals in the Eyak Lake study area;
- (2) to list the birds recorded, their status, abundance, and habitat affinities in the study area;
- (3) to make an annotated list of the mammals occurring in the study area;
- (4) to include special interest species within the study area with comments on land management practices.

The bulk of these data were gathered during the 20 year period from February, 1962 to February, 1982. Some of these data were published in "Birds of the North Gulf Coast - Prince William Sound Region, Alaska" by M.E. 'Pete' Isleib and Brian Kessel, Biol. Papers University of Alaska, No. 14, 1973. Other data within this chapter have been gathered by the consultants in conjunction with other field work and by local Forest Service and Fish and Game personnel. Local residents provided additional information on the occurrence and abundance of some mammals.

DESCRIPTION OF HABITATS

Within the study area we have identified twelve habitat types utilized by birds and mammals, some of which are very limited in area. The presence or absence of preferred habitat types plays a critical role in the distribution and abundance of most birds and mammals.

1. Tundra: In the study area, tundra is alpine in distribution and extremely limited to a few hectares on slopes on the northeast side and is, with few exceptions, little used by birds and mammals. Vegetation consists primarily of low, often mat-forming plants. Important species include Crowberry, Alpine and Dwarf blueberries, Mountain Heather, Alpine Azalea, Alaska Moss Heather, sedges, and a number of other herbs, mosses and lichens.

2. Shrub Thickets: Primarily composed of Sitka Alder, shrubs are extensive in the study area, occurring on steep slopes and along the lakeshore. Being pioneering species, alders and

salmonberry readily invade disturbed areas such as avalanche tracks, stream borders, and cutover areas. In later stages of shrub thicket development, various other forms of woody vegetation become common components including blueberry, Stink Currant, and Red-berried Elder. Shrubs in the Power Creek Delta are also composed of a variety of willows and Red-berried Elder. Often Devil's Club is associated with climax alder thickets, making penetration difficult at best. Other species in thickets include a wide variety of ferns, grasses, sedges, mosses, and, in damp open spots, dense growths of Cow Parsnip and False Hellebore. Shrub thickets vary in height from 2 to 6+ meters, with the taller forms most common in riparian areas.

3. Hemlock/Sitka Spruce Forest: The Eyak Lake study area is phytogeographically a part of the Hemlock/Sitka Spruce coastal/subalpine forests of the Pacific Coast. Occurring in most of the upland of the study area, the forest is primarily composed of Sitka Spruce, and Western and Mountain hemlock varying in height from 15 to 30+ meters and up to 1 meter DBH. The understory of the coniferous forest is composed of many shrubs such as blueberry, Fool's Huckleberry, Sitka Alder, and Mountain Ash (see 2 above). The ground cover is dominated by mosses, a wide variety of herbs, ferns, club-mosses, Dwarf Dogwood, Twisted Stalk, Goldthread, and bramble.

4. Bogs: Known locally as muskegs, bogs are naturally occurring open areas where drainage is poor - generally within coniferous forests. Small areas of bogs occur near the reservoir, above the Copper River Highway, on the slope above the Power Creek Road at the entrance of North Arm, and on slopes around Island Bay and Middle Arm. Sphagnum moss predominates in these sites and, after decades, the underlying decaying vegetation becomes peat. Other plants associated with bogs include sedges, Cotton Grass, Sweetgale, Bog Cranberry, blueberries, Labrador Tea, Crowberry, Bog Rosemary, Cloudberry, Grass-of-Parnassus, and sundew. Small shallow ponds and puddles are commonly associated with bogs.

5. Mixed Deciduous-Spruce Woodlands: Small stands of Black Cottonwood often intermixed with Sitka Alder and Sitka Spruce are located along the lakeshore. Several sites occur along Power Creek Road and the Copper River Highway. The understory vegetation includes a wide variety of shrubs such as salmonberry, Highbush Cranberry, and willows.

6. Marshes: Small areas of marshes are located south of Southeast Arm and the Copper River Highway and on the Power Creek Delta into Eyak Lake. Marshes in the study area include a wide variety of shrubs: willows, alder, Sweetgale. Other species include horsetail, grasses, sedges, Cotton Grass, Grass-of-Parnassus, and vetch. Vegetation within marsh ponds includes pondweeds, manna grass, Yellow Water Lilies, bullrushes, spikerush, buttercup, and Water Milfoil.

EYAK LAKE AMSA COOPERATIVE MANAGEMENT PLAN



Alaska Coastal Management Program

The purpose of this map is to provide a visual representation of the coastal management plan for Eyak Lake. The map shows the lake and its surrounding areas, including the North Arm, West Arm, and Southeast Arm. The map also shows the location of the Eyak Lake AMSA Cooperative Management Plan area.

VEGETATION MAP

- Shrub Thicket
- Grass, Barbs, Scrub Slopes
- Bog (tussock)
- Hemlock-Spruce Forest
- Aspen
- Mixed Deciduous-Spruce Woodland



Figure 8

7. Lacustrine Waters: This includes Eyak Lake (2,400 acres) and the large pond (40 acres) south of Southeast Arm where a pair of Trumpeter Swans nest. The lake vegetations includes a wide variety of aquatic plants. The consultants' survey of the lake has mapped the extent of the vegetation and these data are included elsewhere. The most abundant of these aquatic plants includes Sage Pondweed, Clasping-leaf Pondweed, and Water Milfoil. Yellow Water Lilies occur in several locations near the lakeshore.

8. Fluvial Waters: The flowing waters of the study area include numerous small and short streams draining slopes above the lake. Power Creek is the only flowing water body of substantial volume.

9. Cliffs, Bluffs, and Scree Slopes: Upland cliffs, bluffs, and scree occur on the slopes bordering sections of the study area. Mostly devoid of vegetation, these sites are little used by most birds and mammals, but in some instances may provide nesting sites for ravens and Violet-green Swallows and denning sites for Hoary Marmots.

10. Residential Zones and Man-made Structures: Man-made structures and residential zones offer several alternative habitats to birds and mammals. Nesting and denning sites are available to Tree and Barn swallows and several small rodents. Bird feeders provide additional food sources.

11. Shorelines, Beaches and Open Areas: Along the approximately 20 miles of shoreline on Eyak Lake and the large pond, several forms of rocky, gravel, sand, and mud surfaces provide several micro-habitats. These small areas provide resting, foraging, and/or nesting sites for several bird species. The city airport on the lakeshore is included in this habitat form. Vegetation is sparse or non-existent.

12. Air Above: The study area straddles a portion of the coastal migration corridor. Many bird species that do not utilize lands and waters in the study area are annual migrants through the "Eyak Gap." The list of users includes many waterbirds and raptors, e.g. Sandhill Cranes, Snow Geese, and Peregrine Falcons. (Note: The term "Eyak Gap" is newly coined to describe an avian corridor through air space between the Heney Mountains south of Eyak Lake and the Chugach Mountains to the north. In the spring, birds flying westward across the upper Copper River Delta at a few hundred feet elevation can visually observe a portion of Prince William Sound and often use this short-cut. The reverse route is used by fall migrants, and the gap is used all summer by gulls enroute between Cordova waterfront and the Copper River Delta.)

PHENOLOGY

1. Spring: As the lengthening of daylight hours become apparent in February, spring (if it equates to flowers and singing robins)

is still months away. Yet a re-awakening is in progress. There is a regional population shift of redpolls headed west toward Prince William Sound, and noticeable to the keen observer are the aerial courtship antics of ravens flying to and from their roost on the slope above Northern Arm. Snow Buntings, rarely noticed amid the snow showers, are the first migrants to pass through the study area beginning the second week of March. By the end of March, the paired Trumpeter Swans that wintered in the Eyak system are making daily forays to what may be their nesting ponds on the adjacent Copper River Delta. By the first of April, other swans that wintered farther south, along with Mallards and Pintails, are the vanguard of the thousands of birds that will pass through during the following six weeks.

Spring migrant birds that pass through the study area arrive from the east after crossing the Copper River Delta. If low clouds with rain or snow squalls obstruct migration south of the Heney Range, flock after flock of waterfowl and cranes pass through "Eyak Gap" over Eyak Lake and Cordova before entering Prince William Sound. Peak period for migrant geese is from April 19th to May 9th. The peak for cranes is April 27th to May 12th. Six to twelve miles south of the study area many millions of migrants move westerly between mid-April and the end of May. Phenomenal concentrations of shorebirds occur on the tidal flats of the western Copper River Delta and Orca Inlet. The study area is remote from most of these happenings except when extremely strong southeast winds and rain halt migration and birds are forced to seek shelter. At such times, flocks of shorebirds are found along the shores of Lake Eyak.

The first songbirds are heard in the forest about the study area in April - Varied Thrush in early April, Ruby-crowned Kinglet in late April. The first American Robins and Tree Swallows are observed during the last days of April. The first shorebirds in the study area are Common Snipe and Greater Yellowlegs, arriving the third week of April; their vocalizations of arrival are apparent to anyone visiting the southeast arm of the lake. As the ice in the lake breaks up, many species of ducks and other waterbirds can be found in the open lake waters. By mid-May the songbirds are arriving, at times almost enmasse overnight as migrant waves arrive in the area. Sparrows, thrushes, and swallows are followed by warblers in late May. In the still, warm mornings the forest will seem to ring with calls and songs of many birds.

The area's smallest and one of its most colorful breeding birds, the Rufous Hummingbird, is commonly noted as it arrives in May. Homeowners in the area regularly put out bright red sugar-water feeders to attract these interesting birds. By the end of the first week of June, all transients have passed, and summer resident birds are on their territory. The last to arrive are some warblers and flycatchers.

2. Summer: Great Horned Owls begin nesting in March, Bald Eagles and Trumpeter Swans in April, but most species await warmer weather in May and June to begin nesting. During early June the forest rings with a symphony of bird sounds. By solstice, the official beginning of summer, most young have hatched. The hemlock-spruce forests are home to the Varied Thrushes. In the long daylight/dusk hours of June, their odd, insect-like calls can be heard at all times. The Hermit Thrushes' flute-like series of calls are heard mainly in the mornings and evenings. The loud, bubbling call of the Ruby-crowned Kinglet and the warbling calls of Fox Sparrows are heard during rain or shine along the roads and trails of the study area.

During the summer as well as throughout the year, large concentrations of gulls are attracted to wastes produced by the fish processing plants on the Cordova waterfront. Over 10,000 gulls are semi-resident on or around the waterfront during June, July, and August. In addition to many nonbreeding gulls, breeding gulls from the Copper River Delta where they nest are attracted by the unnatural abundance of food. Many of these gulls regularly pass to and fro through the "Eyak Gap" enroute. At the height of the summer, as many as several hundred gulls at a time utilize Eyak Lake as resting and loitering area. Along Power Creek in summer, one can see views of colorful Harlequin Ducks and the queer little bird that walks on the bottom of mountain streams, the Dipper. Several pairs of each have been found nesting in the Power Creek drainage. Along the northeast lakeshore, loons and mergansers trailed by downy young are frequently seen. Spotted Sandpipers are to be expected. As the summer wanes in late July and August, the first birds to depart are swallows. Flocks of swallows over the lake during late July are beginning their southward migration.

3. Fall: Migration is an important aspect of fall utilization of the area, though it is less dramatic than in spring. Many migrant birds pass through on their way southward, but movement is more diffuse and less hurried, extending from July to December. For the most part, fall migration is the reverse of spring, with birds entering from Prince William Sound heading eastward onto the Copper River Delta.

Fall migration begins in July with swallows. Peak movements of most passerines (song birds) occur between mid-August and mid-September, but thrushes and sparrows are still moving through during October. Periodically, during good cone crop years, mass movements of Pine Siskins and crossbills take place during fall and early winter. Generally, the movement is easterly through the forests. At times these movements also include numbers of Redbreasted Nuthatches. During September and October, large movements of waterfowl and cranes pass over Cordova and the study area to staging marshes on the Copper River Delta. On clear days with light west or southerly winds, a regular movement of hawks and eagles are aloft, moving east on the updrafts of the ridges bordering Eyak Lake.

The Power Creek Delta is heavily used by scavenging gulls and eagles from September until freeze-up. The food source is the dead and dying Red and Silver salmon. Concentrations of diving ducks (up to 300+ individuals) occur in North Arm, Middle Arm/Island Bay, Southeast Arm, and in the west lee of Mavis Island. The largest flocks are principally composed of Greater Scaup. Severe southeast storms and considerable precipitation normally occur in September and October. Some storms are accompanied by prolonged winds of hurricane force. These severe storms restrict migratory movements, and large numbers of sparrows and thrushes are forced down. On these occasions, the shrub thickets will abound with birds. If the storms are timed with the major waterfowl exodus of western Alaska (mid-October), after the storm passes, large numbers of Snow and Canada geese and Whistling Swans arrive over the study area after crossing Prince William Sound from Cook Inlet. As long as Eyak Lake remains unfrozen, several hundred waterbirds are present including gulls, loons, grebes, a few cormorants, Canada Geese, a wide variety of ducks, and a few Great Blue Herons. During freeze-up, the birds that remain are largely concentrated in two areas: Power Creek Delta and the lake outlet near the weir.

4. Winter: As winter sets in during December, impressive numbers of eagles and swans may occur. Up to 400 Bald Eagles have been censused in the North Arm/Power Creek area. Aggregations of several species of waterfowl including over 100 Trumpeter Swans have been censused at the lake outlet/weir. As food supplies of dead salmon diminish, the eagles disperse to other areas. As the lake freezes tighter, some of the swans move to Southeast Alaska.

Annually since 1969, a census of birds has been taken in the Cordova area during the Christmas/New Year period. Two areas in the study area are carefully surveyed: Power Creek/North Arm and the Eyak weir. The censuses have shown that land areas are utilized by relatively few bird species most of which are resident: raptors, ptarmigan, and Spruce Grouse, and several passerines, notably corvids and fringillids. Some fringillids, especially Pine Siskins, crossbills, and redpolls, vary in abundance from year to year, numbering in the thousands some years but being essentially absent in others. Their abundance is related to the food available and is high in good cone crop years.

Even in the coldest weather, some waterfowl remain on small patches of open water near the weir and in the warm upswelling springs on the Power Creek Delta. One of the hardiest of birds, which even sings in sub-zero weather, is the Dipper.

BIRDS OF EYAK LAKE STUDY AREA

During the 20-year period of 1963-1982, the following records of occurrence of birds in the Cordova area have been compiled (see Tables 3, 4, and 5).

Two hundred ten (210) species of birds have been recorded within

10 NM of the Eyak Lake study area. One hundred eighty-six (186) species of birds have been recorded within the study area combined with the Cordova city boundaries. One hundred thirty-nine (139) species have been recorded on or over the Eyak Lake study area.

The great variance between the numbers is due almost entirely to the lack of marine habitats in the study area. But the study area's close proximity to marine habitats and major bird migration routes enhances the areas list as considerable spillover occurs, especially during migration.

From observations of nests or of young that are too young to have traveled any distance, 29 species of birds are known to breed within the study area. Additionally, 20 species are listed as "probable" breeders. This group includes species for which no nests or recently fledged young have been observed. But some presumed breeding pairs have been recorded in preferred habitats doing courtship, defending territory, or carrying food. This suggests that additional fieldwork would prove fruitful in confirming nesting.

Twenty four (24) species are listed as "suspected" breeding birds. This group includes species for which little or no evidence of nesting has been recorded in the study area, but a preferred nesting habitat does occur, and the species nest regularly in contiguous areas. This suggests that breeding within the study area could be confirmed in some cases if a long-term study was undertaken.

MAMMALS OF EYAK LAKE STUDY AREA

The following 31 mammal species have been recorded within the study area.

1. Masked Shrew (*Sorex cinereus*)
2. Dusky Shrew (*Sorex obscurus*)
3. Water Shrew (*Sorex palustris*)
4. Little Brown Myotis (*Myotis lucifugus*)
5. Collard Pika (*Ochotona collaris*)
6. Snowshoe Hare (*Lepus americanus*)
7. Hoary Marmot (*Marmota caligata*)
8. Red Squirrel (*Tamiasciurus hudsonicus*)
9. Beaver (*Castor canadensis*)
10. Northern Red-backed Vole (*Clethrionomys rutilus*)
11. Tundra Vole (*Microtus oeconomus*)
12. Muskrat (*Ondatra zibethicus*)
13. Northern Bog Lemming (*Synaptomys borealis*)
- *14. Norway Rat (*Rattus norvegicus*)
- *15. House Mouse (*Mus musculus*)
16. Porcupine (*Erethizon dorsatum*)
17. Coyote (*Canis latrans*)
18. Gray Wolf (*Canis lupus*)
19. Red Fox (*Vulpes vulpes*)
20. Black Bear (*Ursus americanus*)

TABLE 3. OCCURENCE OF BIRDS IN THE STUDY AREA.

KEY: Abundance		Month	Observation Frequency Period
Common	██████		Observed Daily = Present
Fairly Common	-----		Observed Weekly = Present
Incidental	- - - -		Irregularly Observed = Not Always Present
Rare/Casual		Observed Once or More = Not Always Present

Breeding	K = Known nesting
	P = Probably nesting
	S = Suspected nesting

SPECIES	B R E E D S	J A N U A R Y	F E B R U A R Y	M A R C H	A P R I L	M A Y	J U N E	J U L Y	A U G U S T	S E P T E M B E R	O C T O B E R	N O V E M B E R	D E C E M B E R	Primary Habitat or Area of Use
*Common Loon	K	.	.	.	.	██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters
Yellow-billed Loon													██████	Lake Waters
Arctic Loon						-----								Lake Waters
Red-throated Loon						-----				-----				Lake Waters
Red-necked Grebe						-----				-----				Lake Waters
Horned Grebe	S					-----				-----				Lake Waters
Pied-billed Grebe		██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters
Double-crested Cormorant						-----				-----				Lake Waters/Shoreline
Great Blue Heron		██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	Lake Shore Habitat
Whistling Swan		██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters
*Trumpeter Swan	K	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters
Canada Goose	S					-----				-----				Lake Shore/Marshes
White-fronted Goose						-----				-----				Air above
Snow Goose						-----				-----				Air above
Mallard	K					██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters/Marshes
Gadwall		██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters/Marshes
Pintail	K	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters/Marshes
Green-winged Teal	P	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters/Marshes
Blue-winged Teal						██████				██████				Lake Waters/Marshes
Northern Shoveler	S					-----				-----				Lake Waters/Marshes
European Nigeon						-----				-----				Lake Waters/Marshes
American Nigeon	P	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters/Marshes
Canvas Back						-----				-----				Lake Waters
Redhead						-----				-----				Lake Waters
Ring-necked Duck						-----				-----				Lake Waters
Greater Scaup						██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters
Lesser Scaup		██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters
Tufted Duck		██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	██████	Lake Waters

SPECIES	B R E E D S	J A N B R U A R Y N O V E M B E R	F E B R U A R Y M A R C H A P R I L M A Y J U N E J U L Y A U G U S T S E P T E M B E R	O C T O B E R	N O V E M B E R	D I C E M B E R	Primary Habitat or Area of Use
Common Goldeneye							Lake Waters
Crow's Goldeneye	P						Lake Waters
Goldeneye							Lake Waters
Lesser Goldeneye							Lake Waters
Ring-necked Duck	K						Power Creek Waters
Lesser-winged Scoter							Lake Waters
Lesser Scoter							Lake Waters
Lesser Merganser							Lake & Stream Waters
Common Merganser	K						Lake & Stream Waters
Red-breasted Merganser	S						Lake Waters
Sharp-shinned Hawk	S						Forested Habitats
Sharp-shinned Hawk	S						Forested & Shrub Habitat
Golden Eagle	K						Air Above
Sharp-shinned Hawk	S						Air Above, Forest/Shore
Sharp-shinned Hawk							Air Above
Sharp-shinned Hawk							Air Above
Sharp-shinned Hawk							Air Above
Sharp-shinned Hawk							Air Above
Sharp-shinned Hawk	S						Forests & Woodlands
American Kestrel							Forests & Woodlands
Rufous Grouse	K						Forests
Yellow Ptarmigan	P						Tundra & Shrub
Red-tailed Hawk							Air Above
American Coot							Lake Waters
Red-winged Blackbird							Lake Shore
White-crowned Sparrow							Lake Shore
Lesser Yellowlegs	K						Lake Shore
Greater Yellowlegs	S						Marsh & Lake Shore
Literary Sandpiper							Marsh
Lesser Sandpiper	K						Lake & Stream Shore
Greater Phalarope	P						Lake Waters & Marsh
Common Snipe	K						Marsh & Lake Shore
Red-billed Diver							Lake Shore
Lesser Sandpiper							Lake Shore
Greater Sandpiper	P						Lake Shore & Marsh
Lesser Sandpiper							Lake Shore & Marsh
Lesser Sandpiper							Lake Shore
Lesser Sandpiper							Lake Waters
Lesser Sandpiper							Waters & Shorelines
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Lesser Sandpiper							Waters & Shorelines
Lesser Sandpiper							Waters & Shorelines
Lesser Sandpiper							

CIES	B R E E D S	J A N. F E B. M A R C H A P R I L M A Y J U N E J U L Y A U G U S T S E P T E M B E R O C T O B E R N O V E M B E R D E C E M B E R	Primary Habitat or Area of Use
Black Murrelet	S	.....	Forest
Ring-billed Gull	P	.....	Accidental
Great Horned Owl	P	.....	Forest & Woodlands
Screech Owl	P	.....	Forest & Shrub
Great-eared Owl	P	.....	Shrub & Marsh
Great Owl	P	.....	Forest
Whet Owl	S	.....	Forest
Ruby-throated Hummingbird	K	.....	Forest & Shrub
Red-tailed Kingfisher	K	.....	Shorelines
American Flicker	P	.....	Forest & Woodlands
Red-bellied Sapsucker	P	.....	Forest & Woodlands
Downy Woodpecker	S	.....	Forest & Woodlands
Gray Woodpecker	S	.....	Forest & Woodlands
Western Three-toed Woodpecker	S	.....	Forests
Acorn Woodpecker	S	.....	Shrub
Veery	P	.....	Forest & Shrub
Indigo-bird	P	.....	Cliff Bluffs/Scree/Resid
House Wren	K	.....	Forest & Residential
Chimney Swift	P	.....	Air Above & Shorelines
House Martin	K	.....	Residential
Blue Jay	K	.....	Air Above
Black-billed Magpie	P	.....	Forest & Shrub/Residential
American Raven	P	.....	Forest & Shrub/Shorelines
Western Crow	P	.....	Forest, Residential/Shoreline
Black-capped Chickadee	P	.....	Forest & Shrub
Strut-backed Chickadee	K	.....	Forest
Blue-breasted Nuthatch	S	.....	Forest
Worm-eating Warbler	P	.....	Forest
Parula	K	.....	Flowing Waters & Lakeshore
Carolina Wren	S	.....	Forest
American Robin	K	.....	Forest & Shrub
Indigo-bird	K	.....	Forest & Shrub
White-throated Sparrow	K	.....	Forest & Shrub
Indigo-bird	K	.....	Forest & Shrub
Indigo-bird	K	.....	Shrub & Woodlands
Indigo-bird	S	.....	Forest
Indigo-bird	K	.....	Forest & Woodlands & Shrub
Indigo-bird	S	.....	Lakeshore & Timber
Indigo-bird	S	.....	Forest & Woodlands
Indigo-bird	S	.....	Forest & Woodlands & Shrub
Indigo-bird	S	.....	Residential Areas
Indigo-bird	K	.....	Forest & Woodlands & Shrub
Indigo-bird	P	.....	Shrub
Indigo-bird	P	.....	Forest & Woodlands & Shrub
Indigo-bird	K	.....	Forest
Indigo-bird	P	.....	Forest & Woodlands & Shrub
Indigo-bird	S	.....	Woodlands/Shrubs/Marshes
Indigo-bird	S	.....	Lakeshores

PECIES	B R E E D S	J A N U A R Y	F E B R U A R Y	M A R C H	A P R I L	M A Y	J U N E	J U L Y	A U G U S T	S E P T E M B E R	O C T O B E R	N O V E M B E R	D E C E M B E R	Primary Habitat or Area of Use
Line Grosbeak	P													Forest, Woodlands & Shr
Gray-crowned Rosy Finch	S													Cliffs Bluff & Scree
Park Redpoll														Forest, Woodlands & Shr
Common Redpoll	P													Forest, Woodlands & Shr
Line Siskin	P													Forest, Woodlands & Shr
Red Crossbill	S													Forest
White-winged Crossbill	S													Forest
Savannah Sparrow	K													Marsh
Park-eyed Junco	K													Forest, Woodlands & Shr
Tree Sparrow														Shrub & Marsh
White-crowned Sparrow														Shrub
Golden-crowned Sparrow	K													Shrub
Box Sparrow	K													Shrub
Lincoln's Sparrow	P													Shrub & Marsh
Song Sparrow	K													Shrub & Marsh & Lakesho
Spland Longspur														Marsh & Lakeshore
Now Bunting														Marsh & Lakeshore

TABLE 4. OCCURRENCE OF BIRDS NOT RECORDED WITHIN THE STUDY AREA, BUT OCCURRING WITHIN 10 NAUTICAL MILES OF THE STUDY AREA.

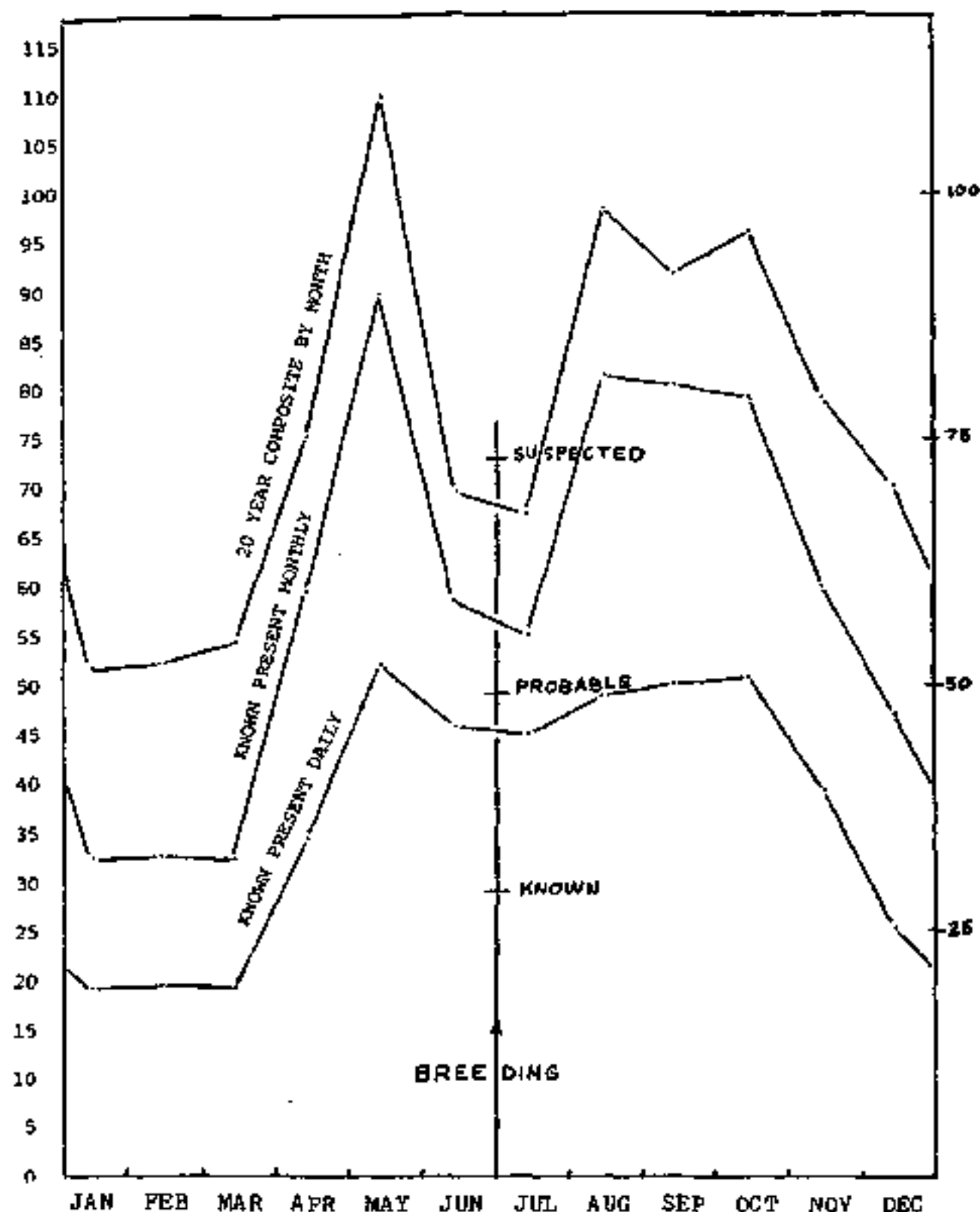
KEY:

Annual = X Rare = R
Common = C Accidental = A
Uncommon = U

SPECIES	ANNUAL	ABUNDANCE	BREEDS	PRIMARY HABITAT
Northern Fulmar		R		Marine Waters
Fork-tailed Storm Petrel	X	U		Marine Waters
Pelagic Cormorant	X	C	K	Marine Waters
Red-faced Cormorant	X	C	S	Marine Waters
Whooper Swan		A		Marshes
Brant	X	U		Tidal Plants
Emperor Goose		R		Marine Waters
Black Duck		R		Marshes
Cinnamon Teal		R		Marshes
Steller's Eider	X	U		Marine Waters
Common Eider		R		Marine Waters
King Eider	X	U		Marine Waters
Black Scoter	X	C		Marine Waters
Red-tailed Hawk		R		Woodlands
Swainson's Hawk		R		Woodlands
Golden Eagle		R		Open Sky
Rock Ptarmigan	X	U	P	Alpine Tundra
Black Oystercatcher	X	C	X	Rocky Shorelines
American Golden Plover	X	C		Tide Flats
Black-bellied Plover	X	C		Tide Flats
Dotterel		A		Tide Flats
Bar-tailed Godwit		R		Tide Flats
Marbled Godwit		R		Tide Flats
Bristled-thighed Curlew		R		Tide Flats
Upland Plover		R		Open Uplands
Wandering Tattler	X	U		Rocky Shorelines
Ruddy Turnstone	X	C		Tide Flats/Rocky Shorelines
Black Turnstone	X	C		Rocky Shorelines
Red Phalarope		R		Marine Waters
Long-billed Dowitcher	X	C		Tide Flats
Surfbird	X	C		Tide Flats/Rocky Shorelines
Red Knot	X	C		Tide Flats
Sanderling	X	C		Tide Flats
Semipalmated Sandpiper	X	U		Tide Flats
Rufous-necked Sandpiper		R		Tide Flats
Baird's Sandpiper	X	U		Marshes
Sharp-tailed Sandpiper		R		Marshes
Rock Sandpiper	X	C		Rocky Shorelines
Curlew Sandpiper		A		Tide Flats
Buff-breasted Sandpiper		A		Marshes

SPECIES	ANNUAL	ABUNDANCE	BREEDS	PRIMARY HABITAT
RUEF		R		Marshes
Pomarine Jaeger	x	U		Marine Waters
Long-tailed Jaeger		R		Marine Waters
Thayer's Gull	x	U		Marine Waters
Ring-billed Gull		R		Marine Waters
Black-legged Kittiwake	x	C	K	Marine Waters
Sabine's Gull	x	U		Marine Waters
Aleutian Tern	x	C	K	Marshes/Marine Waters
Common Murre	x	C		Marine Waters
Thick-billed Murre		R		Marine Waters
Pigeon Guillemot	x	C	K	Marine Waters
Kittlitz's Murrelet	x	U		Marine Waters
Ancient Murrelet	x	U		Marine Waters
Horned Puffin		R		Marine Waters
Tufted Puffin	x	U	K	Marine Waters
Screech Owl		R	S	Woodlands
Snowy Owl		R		Marshes
Common Nighthawk		R		Open Sky
Vaux's Swift		A		Open Sky
Anna's Hummingbird		R	S	Woodlands
Eastern Kingbird		R		Woodlands
Western Kingbird		R		Brushlands
Say's Phoebe		R		Open Uplands
Western Wood Pewee	x	U		Woodlands
Horned Lark		R		Open Uplands
Purple Martin		A		Open Sky
Gray Jay		R		Brushlands
Wheatear		R		Open Uplands
Swainson's Thrush	x	U	P	Woodlands
Gray-cheeked Thrush	x	U	P	Woodlands
Yellow Wagtail		R		Open Uplands
Cedar Waxwing		A		Woodlands
Blackpoll Warbler		R		Woodlands
Northern Waterthrush	x	U		Wet Woodlands
Common Yellowthroat		R		Wet Brushlands
Yellow-headed Blackbird		A		Marshes
Red-winged Blackbird	x	U	P	Marshes
Brown-headed Cowbird	x	U	S	Woodlands
Scarlet Tanager		A		Woodlands
Brambling		R		Brushlands
White-throated Sparrow		R		Brushlands

TABLE 5. NUMBERS OF BIRD SPECIES KNOWN TO OCCUR ANNUALLY BY DAY, BY MONTH AND 20 YEAR COMPOSITE BY MONTH.



(Full one day bird census-surveys in the study area have recorded from a low of 14 species observed in 6 hours during late February to a high of 58 species observed in 9 hours during late May)

21. Brown Bear (*Ursus arctos*)
22. Marten (*Martes americana*)
23. Ermine (*Mustela erminea*).
24. Mink (*Mustela vison*)
25. Wolverine (*Gulo gulo*)
26. River Otter (*Lutra canadensis*)
27. Lynx (*Felis lynx*)
28. Harbor Seal (*Phoca vitulina*)
- ** 29. Sitka Black-tailed Deer (*Odocoileus hemionus sitkensis*)
- ** 30. Moose (*Alces alces*)
31. Mountain Goat (*Oreamnos americanus*)

*Natural expansion of inadvertently introduced populations to contiguous areas.

**Natural expansion of introduced populations to contiguous areas.

The foregoing list is undoubtedly incomplete. Some terrestrial mammals that occur in contiguous areas of the Copper River Delta and Prince William Sound have not been recorded in the study area. Least Weasel (*Mustela nivalis*) and several species of small rodents (mice, voles, lemmings, jumping mice) known or suspected to occur in areas immediately adjacent to the study area have not been specifically researched for inclusion in this resource inventory. A fairly complete inventory would require several months of small mammal trappings throughout the various habitat forms occurring in the study area. The results of such efforts were not considered a priority.

ANNOTATED LIST

1. Masked Shrew
2. Dusky Shrew
3. Water Shrew

Shrews are fairly common resident mammals in a wide variety of habitats in the study area. These three species were observed by the consultants in conjunction with other field work. Masked and Dusky shrews are regularly found in the ground cover of Hemlock/Spruce forests and shrub thicket habitats. Water Shrew is less well known but can be expected to occur on the edges of lacustrine and fluvial water habitats throughout the study area.

4. Little Brown Myotis, commonly referred to as the Little Brown Bat, is presumed to be a year-round resident of the study area, but observations of this are lacking. This animal has been noted somewhat regularly from May to early December but is fairly common only in October when fall migrant populations pass through the region. The consultants, in conjunction with other field work, observed seven individuals catching insects along a short stretch of Power Creek Road on October 14, 1982. Other individuals were observed through the fall near the Power Creek

Delta, along the Copper River Highway, and near the Eyak Lake weir/outlet.

5. Collared Pike occurs locally in alpine scree at higher elevations around Eyak Lake. None have been observed below 500 ft. elevation, but it is presumed that a few occur at or near that elevation on the northeast slopes of the study area.

6. Snowshoe Hares in small numbers occur in forest edge and in shrub thicket habitats on the eastern portion of the study area. Their presence elsewhere in the study area is less regular being dependent to some extent on the stage of cyclic populations from the contiguous uplands of the Copper River Delta.

7. Hoary Marmot occurs as an uncommon resident in the mountains bordering Eyak Lake with some individuals ranging downslope into the study area in alpine tundra and scree slope habitats.

8. Red Squirrels are fairly common residents throughout the Hemlock/Spruce forest habitat. They occur frequently in and near developed subdivided lands bordering the lake and are probably the most frequently observed wild mammal in the study area.

9. Beaver occurs in small numbers in the study area. A few individuals are resident on the Power Creek Delta, and others are irregularly noted on shorelines and banks of Eyak Lake and on the 40-acre pond between the Copper River Highway and Southeast Arm.

- 10. Northern Red-backed Vole
- 11. Tundra Vole

Voies occur in a wide variety of habitats in the study area. Red-backed Vole occurs most frequently in the forest, woodland, shrub habitats. Tundra Voies are most frequent in the drier areas of the marshes and the brushy lowlands along Southeast Arm. Voies and Lemmings are cyclic in abundance, in some years being plentiful and in others almost absent.

12. Muskrats are uncommon in the study area, being most frequent in marsh, pond, and stream habitats near Southeast Arm. Very few individuals range elsewhere around the shores of Eyak Lake.

13. Northern Bog Lemming is a resident through most of the marsh, bog, and forested habitats of the study area. The abundance of this species and other small rodents is not well documented. Some small rodents, however, including voies, lemmings, and mice are in general quite numerous in the study area.

14. Norway Rat is present in Cordova and is resident along the West Arm in the city limits. Its presence elsewhere in the study area is not known, but it can be expected at least irregularly in a wide variety of habitats along the shoreline of Eyak Lake.
15. House Mouse can be expected to occur in or near any human-inhabited structures. This mouse is present in Cordova and in the older structures of "old town" adjacent to West Arm. It is not as pioneering as Norway Rat and probably does not occur away from man-made structures around Eyak Lake.
16. Porcupines are common residents in the Hemlock/Spruce forest habitat throughout the study area. They are regularly observed along the Power Creek Road and the Copper River Highway. Porcupines can be expected to occur in all terrestrial habitats of the study area and are one of the most frequently observed wild mammals in the area.
17. Coyotes are common on adjacent uplands of the Copper River Delta, and they are regularly observed on Eyak Lake when it is frozen during the winter. They occur in the study area most frequently in the uninhabited area between Southeast Arm and North Arm.
18. Gray Wolf occurs irregularly in the study area. A pack of wolves is believed to range through the uplands of the Copper River Delta and west to at least the Rude River Valley in Prince William Sound. Wolves have been reported in North Arm during mid-winter (Jerry McCune, per commun.) when they were presumably en route between the aforementioned regions.
19. Red Fox is an uncommon resident on contiguous upland of the Copper River Delta and is presumed to occur infrequently ranging into eastern portions of the study area. No observations were reported during the winter of 1981-82.
20. Black Bears are residents of forested and shrub thicket habitats of the study area. They range from the alpine tundra slopes above the study area to lake and streamside habitats. Black Bears are most frequently encountered in the North Arm/Power Creek and Southeast Arm areas. No attempt was made to survey the populations visiting the study area annually, but a rough estimate places this annual number at between 20 and 50 individuals.
21. Brown Bears are annually reported in the study area. Semi-resident individuals appear from spring to fall along North Arm, Power Creek, and the northeast shoreline of the lake to Southeast Arm and east to Ibeck Creek. Like Black Bears, Brown Bears are primarily vegetarians but will feed extensively on spawning salmon and prey upon other mammals if they are readily available. A rough estimate of the numbers that annually range into the study area is 10 to 20 individuals.
22. Martins are rare residents in the forest portions of the

study area. Trappers report only a few of these animals in the area. This mammal has been reported more frequently in recent years than in past decades.

23. Ermine or Short-tailed Weasel is a fairly common resident in the study area and is found in a wide variety of habitats including lakeshore and streamside areas.

24. Mink are fairly common residents of lakeshore and streamside habitats in the study area. Mink are trapped along the lakeshore and road systems in November. Mink are also found in other habitats throughout the study area.

25. Wolverine are rare visitors in the study area. This wide ranging mustelid can be expected to occur irregularly in all areas except highly developed or residential locations.

26. River Otter are fairly common residents of the study area. Most frequently observed at the lake weir/outlet, these mammals range widely through the study area and regularly frequent several lakeside and Power Creek shoreline sites.

27. Lynx are very rare visitors to the study area. Found in forest and shrub habitats, they range into the area from adjacent lands on the upper Copper River Delta. Very few individuals occur annually in the study area.

28. Harbor Seals range upriver from Gulf and Delta marine habitats into Eyak Lake in summer and fall. Whether the seals are following salmon for a continued food source or they are strictly randomly wandering, is unknown. Nevertheless, a few to upward of 30 seals have been reported in Eyak Lake during late summer. They have been observed chasing and feeding on spawning salmon while in the lake.

29. Sitka Black-tailed Deer are uncommon residents in the Hemlock/Spruce forests around Eyak Lake. Introduced into nearby Prince William Sound some 60 years ago, the deer subsequently have occupied most of the islands in the Sound and portions of the adjacent mainland. Local hunters report that a small number of deer are resident on the slopes above the northeast shoreline in the Island Bay/Middle Arm area. In conjunction with other field work, the consultants regularly recorded deer tracks along Power Creek Road. Some 25 to 50 individual deer range into the study area sometime during the year.

30. Moose were introduced to the Copper River Delta between 1949 and 1959. Subsequently, a few individuals regularly wander to areas around Eyak Lake. The forests and shrub thickets between Southeast Arm and the Copper River Highway are within the regular range of several individuals in the Ibeck Creek area contiguous to the 40 acre pond. Probably 10 to 20 moose range into the study area annually.

31. Mountain Goats are residents of the upper forested slopes and alpine tundra habitats around Eyak Lake. Rarely do individuals wander to the lower elevations of the lakeshore and the road systems. While most of the year goats remain above 500 ft. elevation, forest and shrub habitats are regularly utilized in winter, especially on the northern sides of the study area. It is estimated that some 20 to 40 goats range into the study area annually.

SPECIAL INTEREST SPECIES

Of all the birds and mammals that use the study area, four birds (Common Loon, Trumpeter Swan, Bald Eagle, and Glaucous-winged Gull) are identified as special interest species. No mammals have that distinction.

Special interest species (or species of special interest) were chosen for specific discussion on the basis of one or several of the following criteria in relation to the entire list of birds and mammals that use the study area: 1) their significance in terms of widespread public interest and sentiment, 2) their susceptibility to human disturbance, 3) their visibility, 4) potential for significant population fluctuations, 5) scarcity, and 6) their potential impact on the human population.

Gavia immer COMMON LOON

The Common Loon is a regular spring and fall migrant on Eyak Lake. During late April and May, migrants are regularly observed flying northwestward through the "Eyak Gap". During ice-free springs some individuals stop to linger and feed before continuing their migration. Up to 20 migrant individuals have been observed on the lake at one time.

Two to four pairs of Common Loons are breeding summer residents on the lake. Their eerie calls, well known to boaters and lakeshore residents, can be heard during the summer's twilight hours. Their shoreline nesting sites include the more secluded shoreline between the Southeast Arm and North Arm and the small islands in Island Bay where adults with downy young have been observed in July.

Fall migrants or late lingering summer residents are regularly noted until the first freeze-up (usually November) and occur as scattered individuals in all areas of the lake. In mild winters in which the lake remains largely unfrozen, the Common Loon has been recorded every month.

Description of Values and Conflicts:

The eerie cries of the Common Loon are legend and well known as loons appear commonly in the mythology of northern peoples. The crazy calls in rebounding echos during the summer twilight provide an extra touch of mystery to the Eyak Lake wilderness setting.

Loons can withstand only limited activity near their nesting sites. Titus and Van Druff (1981), studying the response of the Common Loon to recreation pressure in northeastern Minnesota, found "Hatching success was significantly greater on smaller (generally remote) lakes on no-motor lakes, and for less visible nests. Loon pairs on smaller lakes (trends only), on no-motor lakes, and with few human contacts showed greater success in brood rearing." The nesting area of the Common Loon, once undoubtedly the whole lakeshore, is now restricted to the uninhabited northeast shore between North Arm and Southeast Arm. If human developments and activities were occurring regularly in the Middle Arm/Island Bay area, most if not all of the breeding pairs on the lake would be displaced.

If no continual human activities occur on the northeast shoreline from late May to early July, Common Loons will continue to nest in the area. Roads, homesites and logging are not recommended.

Olor_buccinator TRUMPETER SWAN

The Trumpeter Swan is a well known resident of the Eyak Lake area. Spring migrants that have wintered farther south are among the earliest arrivals on the Copper River Delta beginning in late March. Depending on the availability of open freshwater ponds on the adjacent delta, Eyak Lake is used by migrants to varying degrees during April. Through-bound migrants occur in April and May with several hundred stopping enroute. Non-breeding sub-adults linger after the spring migrants and are occasionally seen until early June before wandering off to spend the summer/late summer molt period at a site remote from disturbance. Martin Lake and Bering Lake, some 50 miles east, are typical summer molt sites. It is probable that Eyak Lake, historically, was also a summer molting lake site for Trumpeter Swans until human disturbances became frequent.

A pair of Trumpeter Swans has repeatedly nested on the 40 acre forest pond a few hundred yards from the end of Southeast Arm. In the past 5 years (1977-81), the pair has raised to flying age a total of 27 cygnets:

1977	=	6	cygnets
1978	=	7	cygnets
1979	=	4	cygnets
1980	=	3	cygnets
1981	=	7	cygnets

Swans are again on Eyak Lake in August as the family group from the 40 acre pond walk overland to the lake and utilize the Southeast Arm. A few pairs and family groups appear on the lake in September, but the majority occur from October to early December. Numbers vary as some leave, others arrive, and other open freshwater areas on the contiguous Copper River Delta remain available. At times during late fall, total numbers in the Eyak Lake study area include several counts of 150 to 250 individuals.

EYAK LAKE AMSA COOPERATIVE MANAGEMENT PLAN



Alaska Coastal Management Program
THE ALASKA DEPARTMENT OF NATURAL RESOURCES, DIVISION OF CONSERVATION AND LAND MANAGEMENT, IN COOPERATION WITH THE U.S. ARMY CORPS OF ENGINEERS, ALASKA DISTRICT, PREPARED THIS MAP FOR THE EYAK LAKE AMSA COOPERATIVE MANAGEMENT PLAN. THE MAP IS A GENERALIZATION OF THE DATA PROVIDED BY THE U.S. ARMY CORPS OF ENGINEERS, ALASKA DISTRICT, AND THE ALASKA DEPARTMENT OF NATURAL RESOURCES, DIVISION OF CONSERVATION AND LAND MANAGEMENT. THE MAP IS NOT A SUBSTITUTE FOR A FIELD SURVEY AND SHOULD NOT BE USED FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT WAS PREPARED.

BIRD CONCENTRATIONS MAP

- Special Areas (see label near each area)
- Migratory and Wintering, waterfowl areas (Sept.-May)
- Migratory Waterfowl (April-June)
- Migratory Waterfowl (Sept.-Nov.)



Figure 9

A few family groups winter on the open freshwater outlet at Eyak weir/river and on the Power Creek Delta. Some 10 to 70 birds have wintered annually at these locations for the past 20 years. During the cold winters of 1970-71 and 1981-82, there was not enough open water to sustain the birds, and mortality occurred. In 1981-82, 9 bodies were counted at the weir/river and 3 bodies at Power Creek Delta. The actual mortality probably included 23 or more birds. Cause of death is attributed primarily to starvation, although actual death was caused by freezing into fast-forming ice, slaying by Bald Eagles, and entanglement by fishing lures and lines.

The Eyak Lake study area is contiguous to the Copper River Delta Wildlife Management Area and the Bering River Trumpeter Swan Management Area, which are areas of special concern to state and federal resource agencies.

Trumpeter Swans are staging a comeback after being decimated. They have actually become extinct in much of their historical range. Their numbers 50 years ago were probably less than 1,000 individuals, but the population today is close to 10,000 of which approximately 7,000 breed and 1,000 winter in Alaska. The adjacent Copper River and Bering River regions have played an important part in this recovery.

Description of Values and Conflicts:

Swans have played a part in human legend and mystery for thousands of years, and swans attract considerable attention. The highway pulloff at the lake outlet is utilized by a large percentage of Cordova residents. At some point during the year, swan watching is a recreational pastime for most Cordova residents and many visiting tourists. The Copper River Highway is the only location in Alaska where this swan can be observed year-round. Cordova has been suggested and promoted as the location for a Swan Research Center by several eminent scientists, wildlife research managers, and the Trumpeter Swan Society.

The primary conflict that affects Trumpeter Swans is their requirement for seclusion at nesting sites. The nesting pair at the 40 acre pond in the study area has been successful due to its seclusion. The location is well screened by a forest fringe, and the marsh between the highway and the forest fringe restricts easy foot access. These swans are known, from banding by the U.S. Fish and Wildlife Service, to be the same birds that winter at the Eyak Lake weir. A similar forest pond approximately one mile south across the highway was used by nesting swans until a road was built to the pond edge two years ago. This constituted sufficient disturbance to displace nesting birds. This example falls in line with Timm's (1978) observations that as cabins are built at swan use areas, the number of cabins had a marked downward effect on the return rate of the swans to these use areas. Timm (1978) found in his study in the Susitna Basin that an overland separation of even 0.5 miles appeared to be an adequate buffer to

human disturbance. If the forest fringe became an area of human disturbance during the summer, undoubtedly this highly productive site would no longer be used. Hansen et. al. (1971) observed that "Although the swans on the Copper River Delta may not have been molested intentionally by the public, the varied and more frequent level of human activity seems to have had a detrimental effect in comparison to the more isolated nesting areas. A forced and rapid movement of cygnets from one body of water to another less secure, induced by human intrusion, appeared to be the greatest factor leading to higher mortality rates."

An additional conflict can occur if the ice in Eyak Lake restricts the swans to a few open areas and these locations are also used by float planes or boating recreationists. This causes a displacement of the swans to secondary locations which may have more limited food resources for swans. Displacement of the birds must be considered detrimental.

Other causes of swan displacement are target practice, discharge of firearms, and waterfowl hunting in the vicinity of resting/feeding swans. These activities are not infrequent on the Eyak Lake shoreline. Cordova area residents become disturbed when these birds are displaced from areas where swan watching is a regular pastime (Eyak Lake weir and Power Creek Delta).

At public hearings in Cordova chaired by the study consultants, comments by lakeshore homeowners frequently included complaints of indiscriminate firearm discharge and small game/waterfowl hunting within range of residential areas and sites where swans were attempting to forage for aquatic vegetation.

Haliaeetus leucocephalus BALD EAGLE

Thousands of eagles annually are visitors through the "Eyak Gap" area. Bald Eagles are conspicuous residents and visitors in the study area in April and May and from October through December. During these months, eagles are numerous in the area as migrants soar on up drafts over the slopes and in lakeshore habitats. The highest one-day count of eagles in the study area is 416 congregated mainly in North Arm/Power Creek on December 27, 1969. The attraction was dead and dying spawned-out salmon. Fifty to 100 eagles at one time in late fall at this site is an annual and expected volume. Higher concentrations are dependent on the availability of alternate food sources to other locations in eastern Prince William Sound and the Copper River Delta.

From June through September and from January through March, eagle numbers are considerably lower than during spring and fall, but some individuals are resident. The only annually-used eagle nest known is on the eastside of Middle Arm. Pairs have been recorded apparently on territory in North Arm and Southeast Arm, but eyries have not been located and nesting attempts or successes are unknown. Historically, Eyak Lake shores provided sites for at least several pairs of eagles, but a reduction of available food

and repeated human disturbances have displaced birds which formerly used these areas. Terres (1980), states human disturbance at nest sites as one of the general causes of declining populations of bald eagles while Mathisen (1968), reported "... human activity at levels existing on the Chippewa (north central Minnesota) is not an important source of disturbance and has no measurable effect on nesting success or nest occupancy. Most human activity around nest sites in this region occurred during the latter part of the nesting cycle when family ties were strongest."; and Newman et.al. (1977), working on San Juan Island, Washington, reported significant increase in human activity near eagle nests have not caused a decline, but, in fact, nest surveys show that numbers of nests and occupied nests have increased significantly.

Stalmaster and Newman (1978), studied wintering bald eagles with the following results: "Eagle distribution and daily activity patterns were changed in response to human presence. Eagles were displaced to areas of lower human activity, preventing effective use of all feeding sites and forcing more birds to use marginal habitat and a smaller area. Feeding birds were disturbed by the mere presence of humans and generally did not return to the site of disturbance for several hours. Sensitivity to disturbance increased with age. Eagles showed evidence of habituation to routine human activities and noise. They were most tolerant when the source of noise was concealed from view. Gun shots caused overt escape behavior. Non-routine activity on the river channel was most disturbing."

In most years nesting activity begins in April, and young eagles fledge in August. During years of late springs with ice and snow lingering on Eyak Lake until mid- or late May, the nesting season is delayed by as much as a month.

Bald eagles are not fully mature until their fifth year, and the life span of individuals may be over 20 years. Paired eagles often remain as mates for a number of years. Young eagles, sub-adults, unmated birds and individuals that have lost their mates may total some 30 percent of the total eagle population. They often wander from one food source to another, and range widely in this quest. The sight of eagles soaring above the upper slopes and peaks of the Chugach and Kenai Mountains is a daily, year-round occurrence.

During late winter when open lake/river waters are restricted to Power Creek Delta and Eyak weir, a few individuals are usually perched on nearby forest lookouts watching for fish, fowl, or mammalian prey. This includes hunger-weakened swans and fish brought to the surface by mergansers or Land Otters.

Description of Values and Conflicts:

The American Bald Eagle is the symbol and national bird of the United States. Bountied in Alaska until 1952, thousands of

eagles were killed annually prior to the removal of the bounty. Indiscriminant shooting of eagles and other so-called "varmits" continued into the 1960's. By the 1970's only a relatively few eagles were shot or shot at. There have been instances, however, where eagles were killed to provide talons and feathers for the jewelry trade.

In the continental United States, the bald eagle is considered an endangered species. Throughout the lower 48 states, declines in certain bald eagle populations have continued from the 1930's to the present in spite of reductions within this past decade of chlorinated hydrocarbon pesticide use.

Loss or deterioration of suitable habitat resulting from human activity may have replaced pesticide contamination as the major contributing factor in the decline of the eagle populations in the lower 48 states.

Here in Alaska, Bald Eagle populations probably increased after the bounty removal in 1952 and stabilized by the end of the 1960's and early 1970's.

Between now and the end of this century, we can expect to see reductions in Alaskan eagle populations as a result of the following growing conflicts:

- (a) elimination of suitable nest trees due to logging activities;
- (b) deterioration of nesting areas due to human activities, e.g., road construction, land developments in currently remote areas;
- (c) disruption of aquatic ecosystems, a prey base for eagles;
- (d) more refined fish and game management schemes which fail to include the food needs of eagles and other animals.

In the Eyak Lake study area as elsewhere, Bald Eagles can withstand only limited human activities near nesting sites. The nesting area of the Bald Eagle, which once undoubtedly included the entire Eyak Lake shoreline, is now restricted to the uninhabited northeast shore between North Arm and Southeast Arm. The pair in Middle Arm is expected to continue to occupy the site if no continual human activities occur on the northeast shoreline from April to August. Roads, homesites, and logging are not recommended.

Larus glaucescens GLAUCOUS-WINGED GULL

The Glaucous-Winged Gull is the common "sea gull" in coastal areas of the Gulf of Alaska. While it does not nest in the Eyak

Lake study area, it is numerically one of the most abundant birds in the area from late April to November. It is present on the nearby Cordova waterfront and landfill site year-round, numbering from a few hundred in mid-winter to several thousand daily during mid-summer seafood processing activities. Some 10,000 Glaucous-Winged Gulls nest on Egg Island on the Copper River Delta, and many of these birds forage into eastern Prince William Sound. Along Eyak River and across Eyak Lake is a regular daily flight route for many gulls that forage along the Cordova waterfront. Of special interest is the gull's use of portions of the study area particularly West Arm.

Besides the flow of traversing birds through "Eyak Gap", many loiter, preen, bathe, and otherwise occupy themselves for hours each day on portions of West Arm.

The most regularly used water area is a few hundred meters east of Powder House Point, 1/4 mile south of the City Airport. Occasionally the runway area of the City Airport is used as is the water area closer to the end of West Arm. When ice covers Eyak Lake, gulls continue to use these areas but to a more limited degree.

Any food sources around Eyak Lake are quickly exploited by gulls. Many gulls are found in spawning areas scavenging dead and dying salmon during late summer and fall.

Several other species of gulls also occur in the study area, and some individuals of other species are found among the Glaucous-winged Gulls loitering in West Arm.

The number of Glaucous-Winged Gulls using these sites varies according to weather conditions, time of day, stage of tide at waterfront sites, and the amount of food resources available on the Cordova waterfront. Gull numbers ranged from 0 to 500+ and were most common from May to October. For several hours each day the birds trade back and forth between lake loitering sites and the Cordova waterfront.

Descriptions of Values and Conflicts:

Gulls add something to the action and form of the study area. Gulls, being scavengers, are a help in cleaning up bits and pieces of animal matter such as fish carcasses and dog feces. Crows, ravens and eagles contribute to this scavenging activity, and little remains unexamined by them collectively in the study area.

These gulls are known to carry many human pathogens that could cause serious health problems if released into the community water supply untreated (Patten and Patten, 1979). The site of the proposed lakewater intake to the city water supply is sufficiently removed to eliminate or minimize this possible hazard.

Gulls roosting near the flight path of aircraft at the city field and the most frequently used float plane area pose a hazard to small aircraft. It is unlikely that the gulls could be displaced from the area by any simple means.

Patten and Patten (1979), consider the unnaturally inflated gull population the result of man enhancing the carrying capacity of the environment for weedy, or nuisance species, which are adapted to disturbed environments and utilize artificial food. They say that Alaska could be on the bill of a major ecological disruption due to the gull population increases and the resulting potential.

ENDANGERED SPECIES

Short-tailed Albatross, Aleutian Canada Goose, and Eskimo Curlew are listed as endangered species of Alaskan avifauna. The American and Arctic Peregrine Falcon are listed as threatened species of the Alaskan avifauna. Of the above species only the Peregrine Falcon is known to occur in the Syak Lake study area.

Three races (subspecies) of Peregrine Falcon occur in Alaska:

- (a) Peale's (Falco peregrinus pealei)
- (b) American peregrine falcon (F. p. anatum)
- (c) Arctic (F. P. tundrus)

The Peale's Peregrine is a large dark Pacific coastal race that is largely non-migratory. And because it is non-migratory, it has not been subjected to high chlorinated hydrocarbon pesticide levels as have the other races. The Peale's Peregrine has not been included with the other races on the list of endangered or threatened species. The Peale's Peregrine is the most frequently observed race in the Copper River Delta/Prince William Sound region. Its nearest known nesting eyries are 40 miles from the study area. Of the other two races, only the Anatum Peregrine has been observed flying over and near the study area. It is considered a very rare irregular migrant visitor through the area.

DISCUSSIONS AND RECOMMENDATIONS

All wildlife habitat is important and all loss of habitat is detrimental to a degree. The degree depends on the extent of similar habitat in the general area that displaced wildlife can move to. While some shift in location of wildlife populations or individuals may occur, usually the same or similar type of habitat is already being used by the affected species. Severe modifications or loss of species or change in it's behavior (loss of breeding activity) could be the long term result.

The eastern shoreline of the lake from Power Creek Delta to the outlet weir is currently undeveloped and relatively undisturbed, and provides important habitat for pink, red, and silver salmon spawning; Trumpeter Swan rearing and over-wintering; Common Loon

breeding; Bald Eagle concentration area and nesting site; and fall resting area for numerous waterbirds.

The area is vulnerable natural habitat with a high natural productivity. It is "essential" habitat for the above mentioned species. Lakeside development is occurring and/or planned for increasing segments of the shoreline and adjacent uplands including some conceptual plans for the eastern shoreline (resort facility, recreational subdivision, and road proposed).

Since private land, which this is, is open for development; a simplistic solution would be to transfer this land back into public ownership where the management can more adequately be publically controlled. Two options, or a combination of the two, exist to resolve this issue -- 1) a tri-partite land trade between the Eyak Corporation, the U.S. Forest Service, and the Alaska Department of Natural Resources; and 2) City of Cordova land claim under ANCSA 14 (c) (3), (a means for the City of Cordova to obtain title to Eyak Corporation land based on a show of need by the City). The lands generally recommended to be transferred back into public ownership are all land north of the Copper River Highway in Sections 30, 31, 32; all of Sections 7, 18, 19, 29; and the portions of Sections 13, and 24 that adjoin

Land trades are complicated, time consuming, and require great justification. In light of this, other possibilities might be better suited to protect the resource values on the backside of the lake. Cooperative management of that land is one such option in which all parties benefit and the resources receive the desired protection. It is recommended that the Eyak Corporation, U.S.F.S., DNR, ADP&G, and the City of Cordova meet following adoption of this plan to prepare a study plan that has the resolution of this issue, in light of but not limited to the above possibilities, as its goal.

Indiscriminate firewood cutting around the shoreline of the lake and in the wetland adjacent to Southeast Arm has caused the elimination of many eagle perching trees as well as other potential threatening alterations of the habitat. It is strongly recommended that timber cutting, except for needed land clearing, be planned and managed to protect the wildlife and scenic resources particularly in the areas shown in Fig. 11. Each land managing agency should revise their cutting regulations/policy and issue conditional permits in the areas where cutting influences habitat and enforce their regulations/policy to stop the past destruction. This should halt impairment of the visual quality of the area as well.

Disturbance of the birds by shooting and waterfowl hunting displaces the birds and can be especially critical during some seasons of the year. An example is harassment of the swans near the weir when the only open water may be right there and no alternative resting/feeding place exists within many miles. Residents near the weir and near Power Creek have testified to the

shooting disturbances. Shooting around human habitation is also very dangerous to the residents. For these reasons the Eyak Lake AMSA should be dedicated as a "bird sanctuary". This should not work much of a hardship on hunters as it would be only slightly less convenient to hunt in an alternate location. The local Department of Fish and Game staff and the Copper River/Prince William Sound Fish and Game Advisory Committee shall both prepare and submit proposals covering this concept for the Game Board meeting following adoption of this plan. This process provides wide opportunity for public input.

The wetland north of the Copper River Highway and adjacent to the weir and Southeast Arm is important in many respects. The most obvious is the highly productive pair of swans that nest on the 40 acre pond in the wetland. They move to the Southeast Arm in the later stages of rearing and finally overwinter near the weir as a family group. The wetland also serves as a natural buffer to flooding and is possibly a recharge area for the aquifer that serves the wells at the residences around Mile 6 and 7. All the more reason to get this land back into public ownership where it can be protected from development.

Motorized traffic is disturbing to the swans and other birds that rely on the backside of the lake and adjacent wetland. The access road to the weir should be blocked off as there are alternate boat launching ramps and picnic sites (ADF&G, DOT/PP, and Eyak Corporation action). Floatplanes have used the weir area at times in the spring during herring seining season when that was the only open water available causing much disturbance to the swans. This practice must cease and now there is an alternative for the planes in the small boat harbor. Enforcement of this restriction will be an educational action with voluntary compliance expected. It is recommended that the game biologist on the local ADF&G staff be responsible for the educational process. Restrictions on floatplane docking in an other section of this plan will aid in the above action.

Off-road vehicles such as snowmachines, airboats, and three-wheelers are agents of wildlife harassment when operated near animals and birds particularly during certain seasons of the year. Regulations should be established by the landowner (Eyak Corporation) of the Power Creek Delta and the wetland adjacent to Southeast Arm to prohibit off-road vehicles in those areas. These regulations should be similar in nature to those in effect on Eyak Corporation land and National Forest Land in the Copper River Delta.

Motor-powered boats are not restricted at this time, however, harassment of wildlife may require future restrictions.

CHAPTER FIVE: FISHERIES

INTRODUCTION

Fisheries resources of Eyak Lake include 10 species of fish (see Table 6), most of which contribute to the commercial, sport and subsistence fisheries of the area. Sockeye and coho salmon are dominant members of the salmon family in the lake and utilize it for spawning, rearing and wintering. Aerial estimates of sockeye salmon spawners derived during 1961 through 1981 ranged from 463 to 28,366 fish with a mean of approximately 11,200 fish. Aerial estimates of coho salmon spawners derived during 14 years between 1964 and 1981 ranged from 150 to 9,200 fish with a mean of approximately 3,200 (Fridgen, personal communication). Small numbers of pink salmon also spawn in tributaries to the lake. King salmon are infrequently observed.

TABLE 6

FISH SPECIES OF EYAK LAKE

<u>Scientific Name</u>	<u>Common Name</u>
<i>Coregonus pidschian</i> (Gmelin)	humpback whitefish
<i>Cottus asper</i> Richardson	prickly sculpin
<i>Gasterosteus aculeatus</i> Linnaeus	threespine stickleback
<i>Oncorhynchus nerka</i> (Walbaum)	sockeye salmon
<i>Oncorhynchus kisutch</i> (Walbaum)	coho salmon
<i>Oncorhynchus tshawytscha</i> (Walbaum)	chinook salmon
<i>Oncorhynchus gorbuscha</i> (Walbaum)	pink salmon
<i>Salmo clarki</i> (Richardson)	cutthroat trout
<i>Salvelinus malma</i> (Walbaum)	Dolly Varden
<i>Thaleichthys pacificus</i> (Richardson)	eulachon

The number of Eyak Lake salmon harvested in the commercial fishery is not known; however, it is conceivable that harvests have exceeded escapements by 50 percent. This is based on commonly observed recruitment rate of 2.5 adults returning per spawner. Coho, sockeye, cutthroat trout and Dolly Varden are taken by sport fishermen in Eyak River. The lake is closed to salmon fishing. The majority of coho salmon caught by sport fishermen in the freshwater areas of Prince William Sound and Copper River drainage have in recent years been taken in Eyak River. Dolly Varden, cutthroat trout and humpback whitefish are also sought after by subsistence fishermen fishing with gillnets in Eyak Lake in winter.

Studies were conducted during late summer and early fall of 1981, winter of 1982, and spring/summer of 1982 to describe and quantify spawning, rearing and wintering habitat on a site and species specific basis. Observations of relative abundance, feeding habits, and length-sex characteristics were also recorded. Aquatic vegetation, clams and snails were also collected for species identification. The following information is a summary.

EYAK LAKE AMSA COOPERATIVE MANAGEMENT PLAN



Alaska Coastal Management Program
This map is part of the Alaska Coastal Management Program, which is a cooperative effort between the State of Alaska and the U.S. Department of the Interior, Bureau of Land Management. The map is intended to provide information for the management of coastal resources and is not to be used for navigation or other purposes.

FISHERY HABITAT

Locations of Juvenile Coho and
Sockeye Salmon

Sept.-Dec.
Jan.-Feb.

Lake Spawning

Sockeye Salmon

Stream Spawning

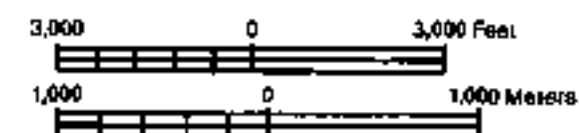
PK—Pink Salmon

CO—Coho Salmon

SK—Sockeye Salmon

CT—Cutthroat Trout

OV—Ooty Varden Trout



Contour Interval: 20 meters

Figure 10

SPAWNING AREAS

SOCKEYE SALMON

Sockeye salmon spawners were widely distributed in Eyak Lake in 1981 and 1982 (Figure 12). Spawning occurred in both stream and lake habitat. Major lake shore spawning populations were found at spawning areas A, B, M, Q, and T. Two tributary streams, Hatchery Creek (r), and Power Creek (s) had spawning sockeye populations totaling about 16 percent of the total spawners observed in 1981. No sockeye spawning was seen in other tributary streams although sockeye use several stream deltas for spawning. Stream deltas are important spawning areas in the lake and contributed about 8 percent of the sockeye spawners. Spring fed gravel beaches adjacent to streams, terminal beaches at the foot of talus slopes and the terminus of an alluvial valley supported the largest spawning populations of sockeye. These areas contributed 76 percent of the total observed sockeye in 1981.

Sockeye spawning areas were identified as such by the actual use of the stream or beach by spawning sockeye. Streams were walked and notes taken on visual estimates of types of substrate, gradient, flow and depth. Distance was measured by pacing and using a measure of three feet per step. Results of stream spawning habitat surveys are listed in Table 7. Of the streams listed in the table only Hatchery Creek, map letter r, and Power Creek, map letter s, were used for spawning by sockeye. Other streams listed in Table 7 have what appeared to be suitable spawning gravel, but for reasons not known these streams were not used. Beach spawning habitat was identified by observing use of the area by spawning sockeye. Each beach was measured by using a skiff for transport, probing the bottom with a metal rod and measuring with a tape out from shore. Potential square yards of beach spawning gravel was calculated for each site in the lake. Results of the measurements are depicted in Table 8 for each spawning beach. A total of 75,361 square yards of potential sockeye beach spawning gravel was calculated for Eyak Lake.

COHO SALMON

Coho salmon were found spawning only in Hatchery Creek (r) and Power Creek (s) tributaries of Eyak Lake (Figure 10). No beach spawning coho were observed although one observation suggested that some coho may have spawned on beach habitat in 1981. In the early 1960's the consultant observed a pair of coho in a small unnamed stream (f) at the head of the West Arm (Figure 10).

From opinions of ADF&G personnel stationed at Cordova, the majority of cohos entering Eyak Lake migrate up Power Creek (Nation, et al, 1980). This study substantiates those opinions and shows Power Creek (s) to be the major coho spawning area of Eyak Lake. On November 2, 1981, 2,177 coho were counted between the Power Creek cable crossing and a point three-fourths mile downstream. Two separate surveys of Hatchery Creek in October,

1981, produced a count of 26 and 50 coho spawners. Coho salmon potential spawning habitat is shown in Table 7 for several streams, but spawning only occurred in Hatchery Creek (r) and Power Creek (s). According to local ADF&G personnel, since much coho spawning in Eyak Lake occurs in October-November and the lake is normally ice covered at this time, it's probably not fair to speculate that there is that there is no beach spawning by coho salmon in Eyak Lake.

DOLLY VARDEN

Spawning populations of Dolly Varden were found in only two tributaries, Hatchery Creek (r) and Power Creek (s), (Figure 10), although several other streams appeared to have suitable spawning habitat. Potential Dolly Varden spawning habitat is given in Table 7. Power Creek is reported to contain a good population of Dolly Varden below Ohman Falls and several large individuals were seen mingling with spawning sockeye in October (Nation, et al, 1980). In past years large numbers (20 -30) of sexually mature Dolly Varden were observed by the consultant being taken from Power Creek in the vicinity of the USGS gauging station in October.

CUTTHROAT TROUT

Cutthroat trout spawning occurs in small, clearwater, gravel-bottomed streams during April through early June, peaking in May (ADF&G, 1978). In Eyak Lake numerous small tributaries have suitable habitat for cutthroat spawning. Cutthroat spawners or reds of spawners were found in nine tributary streams of Eyak Lake (Figure 10). Potential cutthroat spawning habitat is listed in Table 7.

HUMPBACK WHITEFISH

Spawning habitat of humpback whitefish is described as the shallow reaches of rivers and rocky reef areas of lakes (ADF&G, 1978). Sexually mature members of humpback whitefish populations begin movements to their spawning grounds in the summer and early autumn. Spawning takes place in the late afternoon and evening from mid-September to mid-October, with some lake spawners not completing spawning until January (ADF&G, 1978).

Spawning humpback whitefish were not found in Eyak Lake during this study although a few sexually mature fish were captured in gillnets.

REARING AND WINTERING AREAS

SOCKEYE SALMON

Sockeye salmon juveniles in late-fall and early-summer of 1981 were apparently distributed in all offshore areas of the lake. Sampling indicated that nearshore waters were only partially

TABLE 7

SPAWNING HABITAT SURVEYS
OF EYAK LAKE TRIBUTARIES

Map Ltr	Distance Surveyed (Ft.) 1/	Average Width (Ft.)	Average Depth (In.)	Bottom Type					In Percent E 2/	Classification By Species 3/			
				A	B	C	D	E		Ct&D	PX	CO	SK
b	690	10	10	10	40	40	5	5		E	E	E	E
c	315	6	4	2	40	40	15	3		E	E	E	E
g	230	6	6	2	20	15	15	48		C	G	G	G
h	440	6	6	2	2	10	10	73		P	F	F	F
i	210	4.5	4	2	18	10	10	60		G	F	F	F
j	65	1.5	2	2	10	30	10	48		F	E	G	G
k	115	3	2.5	0	5	2	3	90		P	P	P	P
l	30	4	4	30	30	20	10	10		E	G	F	F
m	40	4	3.5	20	30	30	10	10		E	E	G	G
n	65	5	4	10	30	20	20	20		E	G	G	G
p	45	6	5	10	10	20	20	40		F	G	G	G
q	50	8	3	30	40	20	10	0		E	G	F	F
r	5,280	10	6	30	30	20	10	10		E	G	G	G
s4/	5,280	60	18	20	40	20	15	5		E	G	G	G
t	100	6	5	0	2	2	2	94		P	P	P	P
u	3,960	20	12	20	30	30	10	10		E	E	G	G
v	315	12	10	5	20	20	20	35		G	G	G	G

1/ Each stream was surveyed from the mouth to a point upstream considered to be a migration barrier or unsuitable spawning habitat.

2/ A = sand or mud; B = fine gravel; C = medium gravel; D = large gravel; E = rock, boulder or bedrock.

3/ D = Dolly Varden trout; Ct = cutthroat trout; PK = pink salmon; CO = coho salmon; SK = sockeye salmon. P = poor; F = fair; G = good; E = excellent.

4/ Power Creek was surveyed from the mouth upstream to the USGS gauge. The remainder of Power Creek between the USGS gauge and Okman Falls was previously reported upon by USF&WS (Nation, et. al., 1980).

TABLE 8
ESTIMATED AREA OF SUITABLE SALMON SPAWNING
GRAVEL IN EYAK LAKE, BY LOCATION

Map Letter 1/	Location	Square yards of Gravel
A	Five Mile Beach	13,775
B	Collins Residence Beach	2,778
C	Cunningham Residence Beach	8,613
D-E	Murchison Falls Creek to Good Residence	23,701
F	Roadside Parking	156
G	Powder House	544
J	Chisum Air Service Beach	367
K	Blake-Justice Residence Beach	1,944
L	Nippell Beach	694
M	Boat Landing Beach	1,560
N	North Arm Stream Mouth	924
P	Stream South McCune Beach	
Q	McCune Residence Beach	1,667
R	Solf Creek Delta	1,444
S	North Arm Stream Mouth	133
T	Middle Arm South Beach	16,350
U	Queen's Chair Creek Delta	478
Y	Skater's Cabin Beach	233
Totals	Square Yards	75,361
	Acres	15.57

1/See Figure 12

utilized by this species. The determination of winter distribution was not possible due to lack of a means to capture this species when the lake was covered with ice.

COHO SALMON

Data collected during late summer and early-fall of 1981 suggest that major portions of the lake were not utilized by coho salmon juveniles (Figure 13). Locations where fish were caught tended to be clumped together. Greatest densities were observed in the Southeast Arm. Large portions of the central part of the lake and half of the West and North arms of the lake appeared to have been devoid of juvenile coho salmon. According to Crone (1981, personal communication) the distribution of coho salmon juveniles in Eyak Lake appears to be typical of their distribution in lakes jointly inhabited by sockeye salmon juveniles. In the presence of sockeye salmon, coho salmon tend to inhabit the nearshore water where they commonly feed on benthic invertebrates or whatever is available. Sockeye salmon have finer gillrakers than coho salmon, and, in the pelagic offshore waters of a lake where zooplankton are commonly the major prey, they can outcompete coho salmon. Locations where coho salmon were captured tended to be areas in which large, surfacing vegetation was noted. This vegetation may serve as preferred substrate for prey and protective cover for coho salmon. The true distribution of sockeye salmon may be related more to where the vegetation and the more territorial coho are distributed. Analysis of stomach contents indicates that 99 percent of coho salmon juveniles were feeding in late-summer and early-fall of 1981 and that 50 percent were feeding on insects and 34 percent were feeding on snails.

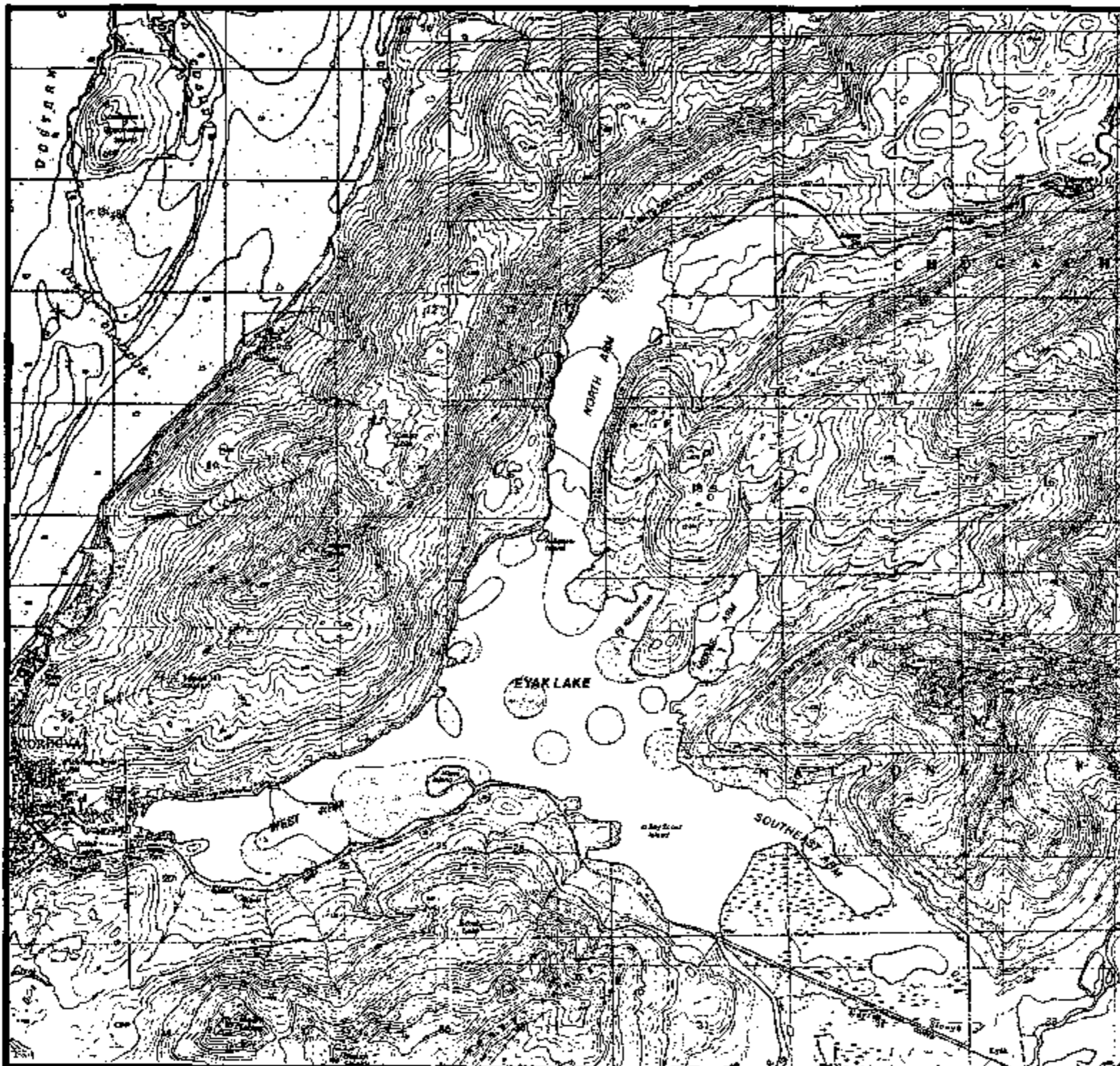
Data collected in winter of 1982 suggest that more of the lake was utilized in winter than in summer (Figure 10). The highest concentrations were observed in the West Arm. The wider distribution may reflect the loss of prey habitat associated with winter die off of vegetation. Analysis of stomach contents indicates that 66 percent of juvenile coho salmon were feeding in winter and that 14 percent were feeding on snail and 12 percent were feeding on insects.

DOLLY VARDEN

Dolly Varden of Eyak Lake are believed to be anadromous. Catch data suggest that Dolly Varden utilize the lake as an over-wintering area.

Data collected during late-summer, early-fall and winter suggest that fingerling Dolly Varden (less than 171 mm overall length) were few in number and/or inhabited only a few areas of the lake (Figure 11).

Analysis of stomach contents suggest that all fingerling Dolly Varden were feeding in late-summer and early-fall of 1981 and that approximately 57 percent were feeding on snails and 40 percent



EYAK LAKE AMSA COOPERATIVE MANAGEMENT PLAN



Alaska Coastal Management Program
 A joint venture of the Alaska Department of Natural Resources and the Office of Alaska Coastal Management, working in cooperation with the U.S. Department of Commerce, Alaska Department of Fish and Game, and the U.S. Department of the Interior, Bureau of Land Management.

DOLLY VARDEN LOCATION MAP

Locations of Dolly Varden Trout

Sept.-Nov.
 Jan.-Feb.



3,000 0 3,000 Feet
 1,000 0 1,000 Meters
 Contour Interval: 20 meters

Figure 11

were feeding on insects.

Data collected in January and February, 1982 suggest that only 29 percent of the fingerlings were feeding. Approximately 61 percent of feeding fish had snails in their stomachs.

Fish larger than 171 mm were captured generally in all offshore areas of the lake during both the open-water and iced-over periods. Gonad inspections suggested that spawning commenced in early October, 1981.

Stomach content analysis of fish larger than 171 mm indicated that 59 percent were feeding in late-summer and early-fall, 1981 and that 29 percent were feeding in January and February, 1982. During the open water period, 43 percent of feeding fish contained salmon eggs and 29 percent contained snails. During winter, 62 percent of feeding fish contained snails.

CUTTHROAT TROUT

This species is also believed to be anadromous, entering the lake in late summer, spawning in spring and out migrating shortly thereafter. No fish smaller than 151 mm were captured during summer, fall and winter. These data suggest that recruitment is low. Catches during summer, fall and winter also suggest that cutthroat trout were less abundant than Dolly Varden, and that distribution was limited to southern portions of the lake. Roughly one-half of the trout contained food items during both open water and winter periods. Fish were the predominantly observed food item.

OTHER SPECIES

Other species collected included threespine stickleback, humpback whitefish, king salmon, eulachon, sculpin and seven species of molluscs. Stickle back were the most abundant species of other finfish species captured. As with coho salmon, stickleback were distributed, during late-summer and early-fall, primarily in the peripheral areas of the lake and tended to be absent in the central portion of the lake. In winter, this pattern changed, and this species was captured in most locations.

Humpback whitefish catches consisted of large specimens 242 to 422 mm. The lack of juveniles suggests a low recruitment rate. The distribution of this species was difficult to define due to the low catch rate.

Two king salmon adult and one eulachon were also captured. Sculpin were infrequently captured.

Molluscs collected consisted of three species of clams and four species of snails.

DISCUSSION AND RECOMMENDATIONS

Fishery production is very much tied in with water quality so that the management provisions pertaining to water quality will also benefit the fishery resource.

Dissolved oxygen (DO) sampling should be conducted periodically when the lake is ice covered to delineate anaerobic (DO deficient) areas and determine the suitability of the lake as fish wintering habitat. Efforts should be concentrated in late winter and when the ice is snow covered.

Minnow trap sampling during January and February, 1982 indicated the presence of at least two areas where DO concentrations near the bottom were insufficient to sustain coho and sockeye salmon fingerlings captured in minnow traps. It is believed that this apparent low DO is due to decomposition of macrophytes (submerged vegetation) and possibly domestic sewage.

Further studies are recommended to improve the information base upon which fisheries management activities are directed. The trophic status of the lake must be determined with ortho-phosphate testing and analysis and phytoplankton sampling and analysis as a minimum. The relationship between dissolved oxygen and the biochemical oxygen demand must be established. Attempts must be made to determine the source or sources of the cadmium and lead found in the water samples. Core sampling of the lake bottom is needed to determine the build-up rate of sediments and the general pattern of build-up.

There are possible solutions to the above problems. To site some examples for a high BOD situation: aerate the water with bubbler pipes, increase winter lake depth for increased water under the ice, eliminate sewage inflow that uses oxygen in decomposition, weed control to reduce the mass of decaying vegetation, or dredging to increase water depth. Recognizing that some of the possible solutions are not as feasible as others, there are, in fact, solutions.

Management of the fisheries of the Eyak Lake system is hampered by the lack of monitored and adequately quantified data although escapement has been documented for sockeye salmon for 25 years. In order to gather the proper data so that control of the fishery is more positive, ADF&G should make provision to modify the weir structure to: 1) allow greater control of the lake level; and 2) provide for counting returning adult salmon, cutthroat trout, and Dolly Varden, and outmigrating juveniles. The lake level control (possibly a "stop log" dam) is expected to allow faster discharge in the summer and maintain summer water level during winter.

The cutthroat trout population in Eyak Lake is apparently rather limited. To assure the future of an Eyak Lake population requires the protection of tributary spawning streams. All tributary streams should be closed to cutthroat trout fishing. ADF&G staff

and the local Fish and Game Advisory Committee should submit proposals to the Board of Fisheries to close the Eyak Lake tributaries to cutthroat trout fishing.

The "sheet pile" water level control structure should be modified to allow for greater control of the lake level and provide a weir for counting adult and juvenile salmon as well as Dolly Varden and cutthroat trout.

The lake level is commonly highest during the sockeye salmon spawning season and lowest during winter. Sockeye salmon commonly spawn in numerous nearshore areas around the lake. Alevin (yolk fry) survival may be adversely impacted by lake level drawdown (normal lowering after fall rains) and the resultant dewatering or freezing of spawning areas. A removable "stop log" dam installed at the outlet may allow for faster discharge of the lake in summer and the maintenance of the summer water level during winter. Another type of outlet control structure may be required beyond the "stop log" dam. Outlet flow modifications, however, may influence ice conditions and the resident Trumpeter Swan flock. Another outlet structure could be constructed, possibly at the west end of the lake, to control flooding on the lake. This is discussed elsewhere in the report.

A counting weir may provide the fishery manager with a means to manage the commercial and sport fisheries and achieve the optimum escapement and maximum harvests of sockeye and coho salmon. According to Koenings (personal communication) the sockeye salmon productive potential of a given lake is commonly related to the volume of the euphotic zone or light penetration zone of the lake. He has observed that an "average" sockeye salmon lake produces approximately 2,800 adults (catch and escapement) per one million cubic meters of euphotic zone. It is estimated that the euphotic zone of Eyak Lake encompasses roughly 24 million cubic meters. The productive potential of the lake may, therefore, be 67,000 adult sockeye salmon. Assuming a recruitment rate similar to Bristol Bay sockeye salmon of 2.5 adults returning per spawner, this equates to an average escapement of 27,000 fish and an average harvest of 40,000 fish. Estimates of escapement magnitude during 1961 through 1981 indicated an average escapement of 11,200 sockeye salmon. An increase in average escapement magnitude from 11,200 to 27,000 fish could result in an increase in harvests from an estimated 17,000 fish to 40,000 fish. Assuming an average weight of 7.0 pounds and an average ex-vessel value of \$1.40 (1981 dollars), the commercial value of sockeye salmon harvested would increase from an estimated \$165,000 to \$392,000.

A comparison of estimates of the amount of sockeye salmon spawning area and estimates of the minimum territorial requirements of female sockeye salmon suggest that sufficient spawning area is available for 27,000 spawners. The amount of beach and stream (Hatchery and Power Creeks) was estimated to be 75,000 square yards and 370,000 square yards respectively. Mathisen (MS Thesis) observed at Pick Creek (Wood River in western Alaska) that female

sockeye salmon require spawning territory of 4.4 to 8.3 square yards to spawn successfully.

The data base for estimating the potential of Eyak Lake for producing coho salmon is unfortunately not as complete as that for sockeye salmon. In lakes inhabited by sockeye and coho salmon juveniles, coho salmon tend to restrict their distribution to the littoral zone, i.e., those areas inhabited by submerged vegetation. A comparison of estimates of adult coho salmon production of five nearby sockeye-coho lakes and estimates of the volume of the littoral zones of these lakes suggest that an average of 900 adult coho salmon may be produced per million cubic meters of littoral zone waters. This is based on available escapement data, actual or assumed return data and bathymetric measurements taken at Martin, Little Martin, Tokun, McKinley and Bear (near Seward) lakes. Data collected during late-summer and early-fall, 1982 suggest that approximately 50 percent of Eyak Lake was utilized by coho salmon juveniles during the ice-free period. The majority of fish growth occurs during this period. The volume of the portion of Eyak Lake utilized by coho salmon is estimated to be 12 million cubic meters. The productive potential may, therefore, be estimated to be 8,000 adult coho salmon. Assuming a recruitment rate of 2.5 adults returning per spawner, this equates to an average escapement of 3,200 fish and an average catch of 4,800 fish. Aerial escapement surveys indicate that the average escapement during 11 recent years has been approximately 3,200 coho salmon (this is not a highly reliable escapement estimate as escapement data is extremely limited and, in addition, consists of early season peak counts).

Spawning area is not considered to be a factor limiting coho salmon production in Eyak Lake. The majority of coho salmon spawn in Power Creek and Hatchery Creek. Fingerling length data collected during 1981 suggest that two age classes of coho salmon were present and that food availability may limit coho salmon production. According to Koenings (personal communication) coho and sockeye salmon juveniles under optimum conditions grow quickly and the majority leave the lake environment after one year. Competition for food and space with subsequent generations is minimized. In situations in which the number of juveniles is excessive in relation to food supply or space, fish grow at a slower rate and do not reach smolt size until the second or third year of lake residency. The parent escapements associated with the two age classes encountered in 1981 encompassed 6,000 and 9,200 spawners.

A smolt weir would allow management personnel to count the outmigration of sockeye and coho salmon as well as Dolly Varden and cutthroat trout. Total outmigration estimates when used in conjunction with length, weight, age, and escapement data would be useful in the determination of optimum escapement levels. Smolt marking could be conducted to facilitate the determination of marine survival rates and harvested areas.

For purposes of the discussion in this section, a number of calculations including spawning densities, survival rates, carrying capacities, fishery interception rates, etc., are theoretical and are based on or extrapolated from other studies and are not necessarily directly applicable to Eyak Lake.

Aerial and ground escapement survey methods utilized in the past should be continued after an adult weir is installed to gauge the accuracy of historic escapement counts.

The food habits of sockeye and coho salmon as well as Dolly Varden should be monitored in conjunction with plankton and benthic food studies. These data would be useful in the determination of lake carrying capacity.

To prevent further encroachment on the spawning beds from lakeshore development the Alaska Department of Community and Regional Affairs should provide technical assistance to the City of Cordova in pursuing funds to document the existing shoreline, both already developed and expected to be developed with a series of photographs and field notes. Any non-permitted encroachment that is detected can then be verified and proper measures taken. In this same vein, DOT&PF shall coordinate their road work with ADF&G so that roadfill that might enter the lake can be directed to suitable sites.

In view of the possibility that upland development may be harmful to the underground aquifer, and not having adequate knowledge of the hydrological regime, it is recommended that permitting agencies review development proposals and, where necessary, require hydrologic investigation attesting to specific engineering practices or structures that would alleviate or mitigate the problem. It is also suggested that ADF&G study the feasibility of amending AS 16.05 and 5 AAC 95 to include underground aquifers in the regulations.

Proposed development activities involving the excavation of hillside areas should be reviewed to ascertain the impact of excavation on the underground flow of water from upland areas to near-shore spawning areas. The usefulness of these spawning areas may largely be dependent on the continued flow of water. A specific example of a potential problem is in regards to the borrow pit at Mile 5 1/2 CRH. Groundwater running down the mountainside forms the aquifer that upwells through the gravel of the spawning beds keeping the fish eggs alive. At the borrow pit the soil and underlying gravel and rock fragments have been removed down to bedrock causing the ground water to become surface water and follow surface water courses into the lake. This may effectively cut off the aquifer to the spawning gravel although some water may seep back into the aquifer below the pit. Freezing weather conditions may intensify the process as the groundwater reaches the surface on the exposed bedrock and freezes.

A dearth of specific knowledge about the hydrological regime is

apparent for the area around Eyak Lake and, more particularly, about the underground aquifer system and its relation to the salmon spawning beds in the lake. To correct this situation, a hydrological study is recommended that would establish the surface and groundwater dynamic regime surrounding and including Eyak Lake and relate this information to a set of guidelines that include recommendations with respect to road construction, clearing of vegetation, building construction, and waste disposal so that the biological productivity of the lake is maintained.

CHAPTER SIX: THE VISUAL RESOURCE

Where land and water meet as in the Eyak Lake study area, there are special opportunities for development and special needs for environmental protection. This is even more important in the study area as the land portion rises abruptly from the lake shore to majestic alpine mountain tops. The visual landscape thus becomes a dominant factor influencing feelings and attitudes about the area and concern is evident about the quality of this visual environment. Because of this concern, it has become appropriate to establish the "visual landscape" as a basic resource, to be "treated as an essential part of and receive equal consideration with the other basic resources of the land".

In order to deal with this visual landscape resource in some objective way, it must be described, categorized, analyzed, and whatever else is necessary so that we are all looking at it in approximately the same way. For purposes of this plan, a "system" that was developed by the U.S. Forest Service was chosen (USFS, 1977 and 1979). The USFS system was developed to identify the visual characteristics of the landscape and to analyze, in advance, the visual effects of resource management activities. Simplistically, the Forest Service proposed to inventory the visual resource and to provide measurable standards for the management of it. (A more detailed description of the system can be found at the end of this chapter.

Applying the system to the Eyak Lake study area, variety of the landscape was characterized because landscapes with the most variety and diversity have the greatest potential for high scenic quality. This was based on the distinguishing characteristics of landform, rock formations, waterforms, and vegetative patterns and, as one might guess, the AMSA rated in the highest classification - the Variety Class was Class A.

Then another classification was made for the area Sensitivity Level. This is basically a measure of people's concern for the scenic quality and again the area reached the highest sensitivity level - Level 1.

When these two classifications (Variety Class A and Sensitivity Level 1) are put into the "system", the result is Quality Objectives which are keyed to the variety classes and sensitivity levels. There are five quality objectives for the visual management of the lands and each one describes a different degree of acceptable alteration of the natural landscape based upon the importance of the esthetics.

The Quality Objective for the Eyak Lake area was found to be Retention. Retention is defined as, "This visual quality objective provides for management activities which are not visually evident". Under this objective, activities may only repeat form, line, color, and texture which are frequently found in this type of landscape. Also, changes should not be evident in

the size, amount, intensity, direction, pattern, etc.

Retention also defines how long the changes, that an activity or operation creates, should be evident. It calls for immediate reduction of the evidence of the change. In other words, if logging occurred in the AMSA, the visual change on the landscape because of the logging, would have to be taken care of during the operation or immediately after. There are many ways to reduce the contrast that activities create on the landscape, such as seeding vegetative clearings and cut or fill slopes, hand planting of large stock, painting structures, etc.

The bottom line is that visual impacts in the AMSA should be mitigated to maintain the appearance of the natural diversity of the landscape in line with the sensitivity of the viewer.

Applying the U.S. Forest Service's Visual Management System to the area, personnel of the Chugach National Forest found:

The Eyak Lake area is highly scenic. The large lake, steep mountains, and the vegetation patterns combine to make a highly interesting landscape. The area is on the border between the Prince William Sound and the Yakutat Character Types. The Variety Class for this area is Class A - distinctive to the character type. The Sensitivity Level for Eyak Lake, the Copper River Highway and the road to Power Creek are all Sensitivity Level 1. This means that the majority of the people using these places and viewing the surrounding landscape have a high concern for what they see. Because of the lake and two roads, most of the surrounding landscape is visible from at least one place. Areas within about 1/2 mile of the lake shoreline are seen in foreground and beyond 1/2 mile are seen in middleground. Because of the enclosed area (by mountains) and the limited viewing distances there is no background seen area (beyond 5 miles). The resultant Visual Quality Objective (VQO) for the area around Eyak Lake and essentially to the ridgeline surrounding it is Retention (of the visual character). This means that management activities, i.e., road construction, timber sales, power lines, etc., should not be visually evident. Any visual impacts created should be mitigated immediately. Additionally, activities should be designed with an emphasis to minimize visual impacts.

For those readers who desire more details on the system, several excerpts from Visual Character Types (USFS ,1979) are presented below:

As part of the land planning process the scenic quality of individual landscapes are classified according to the amount of variety present. This helps to determine these landscapes which are most important and those of lesser value from a scenic quality standpoint. This classification is based upon the premise that all landscapes have some value, but those with the most variety or diversity have the greatest potential for high scenic quality.

The visual character types recognized here for Alaska's National Forest lands are discreet geographic units of land each having distinguishing visual characteristics of landform, rock formations, waterforms and vegetative patterns. Character types are usually based upon total visual characteristics and not upon any one single characteristic, although landform may at times be most influential. The physiographic features of the land were used as an initial basis for determining visual character types based upon Physiographic Division of Alaska (Wahrhaftig, USGS) and Landscapes of Alaska (USGS). In addition vegetative features based upon Major Ecosystems of Alaska (Joint Federal-State Land Use Planning Commission for Alaska) was used to further adjust character type boundaries according to vegetative type and quantity.

When classifying landscape variety for extremely large areas of land, the need for frames of reference quickly becomes apparent. If, for example, the frame of reference were based on entire southeast Alaska (Tongass Forest) some of the large land areas of comparatively less spectacular scenery might have much of their entire visual character modified leaving relatively small remnants of the natural character. Such a gross change would be inappropriate to human scale and use. For example, the whole of a major island might be treated as one variety class while users of the island may in fact find a range of visual experiences within the context of that particular island.

Objectives for defining the visual character types for Alaska's National Forest lands are:

- To serve as frames of reference (character types) for classifying the relative scenic quality of the land's physical features.

- To establish criteria for determining Variety classes.

- To help ensure that management direction and activities maintain a range of visual experiences in each character type as the Visual Management System is implemented.

Highway between Cordova's corporate limits and the Lakeshore trailer court. The Lakeshore trailer court contained a total of 35 trailers in February 1983; while the power plant, 2 Forest Service crew houses, a Forest Service warehouse and 3 trailers were located in the immediate vicinity of the power plant at the corner of the Copper River Highway and LeFevre Street. Eight single family dwelling units, 3 trailers, a shed and the offices of the Eyak Corporation were located along LeFevre Street between the Copper River Highway and Lake Avenue; a 5-plex, a 4-plex, a warehouse, Nirvana Park and an old cemetery are located off Lake Avenue between LeFevre Street and the Eyak Lake airstrip; and several aircraft hangers, an automotive repair shop, air taxi service offices, 2 single family residences and 2 apartments were counted adjacent to the Eyak Lake airstrip. Along the Cordova Highway, (Power Creek Road) beyond the airstrip to Cordova's corporate limits, a cannery, 6 single-family dwelling units and a skater's cabin were identified; while between Cordova's city limits and the end of the road at Power Creek, another 4 single-family dwelling units (one on an island in Eyak Lake) were recorded.

In summary, a total of 113 dwelling units were recorded on both sides of the road along the shores of Eyak Lake in February 1983. By type, 57 were single-family dwelling units, 13 were apartments or multi-family structures (dwelling unit counts did not include units north of Lake Avenue except the ones fronting on Lake Avenue) and the remaining 43 were in trailers. Commercial uses in the study area included a restaurant, a bar, offices of the Eyak Corporation and air taxi offices at the Eyak Lake airstrip. Industrial-type uses included the Cordova power plant, a Forest Service warehouse, a small cannery, a construction headquarters, a welding shop, two aircraft service shops, hangers associated with operation of the Eyak Lake airstrip, the airstrip itself and several warehouses and sheds. Miscellaneous public and semi-public uses included Nirvana Park, an old cemetery and a picnic ground plus a skater's cabin.

FUTURE DEVELOPMENT PATTERNS

In terms of future development patterns in the Cordova area, it is not anticipated that they will change much from those which presently exist in this community. No fundamental changes in the community's economy have been forecasted to take place. Therefore, no dramatically new demands for different types of land are expected to be felt.

Cordova has been fortunate in that it has managed to retain a single dominant commercial district on the bluff area overlooking the harbor. Some additional commercial development has taken place adjacent to the boat harbor, much of it serving the needs of the transient fishing fleet and of seafood processors in that area. No significant drift of commercial uses is expected to take place outside these two areas in the future.

Cordova's existing industrial areas are also generally well defined. They are centered around seafood processing activities and require locations with tidewater access on Orca Inlet. Several scattered industrial sites have developed over the years in the AMSA such as the Airport, power plant, and, most recently, the water treatment plant which is currently under construction. The City is in the process of increasing the efficiency of its boat harbor and creating new industrial areas adjacent to it through the use of dredged materials. Thus, no significant new demands for general industrial space outside these existing areas are foreseen in the Cordova area in the foreseeable future.

There is no well defined warehousing area in Cordova, excluding fisheries storage areas. A good deal of use is located in the Old Town area, often mixed with residential single-family units and trailer courts. The City's 1976 comprehensive development plan recommended an area in the vicinity of the power plant extending north to Chase Avenue and across the south side of the Copper River Highway be reserved for light industrial use, primarily reflecting existing land use in that area.

Future residential development is the critical element in Cordova's future land use pattern. While the addition of more apartment units in the area uphill from the business district is likely to take place in the future, development in this steep area is difficult and expensive and it is probable that an increased share of new homes in the community will be built in the area out Whitshed Road and along both sides of the road around Eyak Lake in the future. Development of the Eyak Corporation's subdivision beyond the present end of Whitshed Road should result in Cordova's residential development pattern becoming much more dispersed in the future and will also necessitate an upgrading of Whitshed Road. The more limited availability of building sites should result in a lesser amount of residential development around Eyak Lake than is expected out Whitshed Road. However, the scenic attractiveness of Eyak Lake puts lots in this area at a premium.

Eyak Lake Study Area

With a few notable exceptions, development along both sides of the road around Eyak Lake is predominately residential and is expected to remain so through the future. The two major exceptions to this are the Cordova power plant and the Eyak Lake airstrip, both of which are expected to remain in their present locations although the power plant has been associated with some pollution problems in Eyak Lake in the past.

In terms of future development patterns around Eyak Lake, it is projected that no significant new industrial uses will locate in this area under the "high", "low" or the "most probable" development rate assumptions, except for the possible addition of hangar and other facilities associated with the Eyak Lake airstrip. Similarly, no significant additional commercial development is foreseen in this area. Thus, probable

future development patterns are assessed in 5-year time frames under "high", "low" and "most probable" development rate assumptions only for residential uses.

At the present time, about 11 percent of all housing units in the immediate Cordova area are located along both sides of the road around Eyak Lake. Based in part on knowledge of building plans by several individuals around the lake, it is projected that the percentage of Cordova's dwelling units which are in the study area will increase to 13 percent of all units in the community by 1988 and remain at that rate thereafter under a "most probable" development rate scenario. Under a "low" development rate scenario, it is assumed that the proportion of dwelling units in the study area will increase to 12 percent of all those in the community by 1988 and remain at that rate through 1998.

The "high" development rate scenario assumes that a relatively large proportion of new development around Eyak Lake will be in the form of trailers. Under this scenario, dwelling units in the Eyak Lake study area would account for 15 percent of all those in the immediate Cordova area from 1988 through 1998.

In terms of numbers, the number of dwelling units along both sides of the road in the Eyak Lake study area under a "most probable" development scenario should be in the neighborhood of 139 by 1988, 152 by 1993, and 170 by 1998 (see Table 11). The "low" development rate scenario envisages slightly fewer units -- a total of 128 by 1988, 145 by 1993, and 156 by 1998. The "high" scenario foresees significantly more -- 160 by 1988, 176 by 1993, and 196 by 1998.

In terms of type of residential units which are most likely to be added in the Eyak Lake study area during the next fifteen years, it is likely that single family units will continue to predominate. However, the addition of another trailer park is rumored and at least several trailers appear likely to be added. Construction of more multi-family units also is likely, especially in the LeFevre Street/Lake Avenue area.

DISCUSSION AND RECOMMENDATIONS

As the human use analysis pointed out: no significant new industrial uses will locate in the AMSA except for facilities associated with the airstrip; no significant commercial development is foreseen; and residential uses are the only uses anticipated with single-family units predominating. By 1998 under the "most probable" development scenario 170 dwelling units will be located within the AMSA including those just outside the AMSA in the area of Mile 6-7 of the Copper River Highway. At present there are 112 dwelling units including 46 in the Mile 6-7 area. In the next 15 years 58 new units are anticipated.

The policies and allowable uses stated later in this plan infer that residential is the preferred and best use of the land around

the lake with the exception of those areas needed for habitat protection and recreation pursuits. Control of land use and development to meet this goal may be achieved in several ways: through various forms of land use control and development regulation such as zoning; through governmental policy on location of public facilities and services, such as roads or sewer lines. Since a small portion of the land in the AMSA is within the Cordova City limits and, therefore, regulated by zoning and a comprehensive development plan, this leaves the major land area outside municipal zoning control. Land owned by the State outside the city limits will conform to the controls established in this plan as a form of zoning. Federal lands are not bound by State coastal management plans, except for spillover effects caused by projects on federal lands onto state, municipal, or private lands. Development of the private land outside the city limits is another story and must be controlled in another fashion. This will be accomplished by the permitting agencies as they review development proposals in light of the policies in this plan.

The City of Cordova may be able to exercise extra-territorial jurisdiction over the Eyak Lake watershed pursuant to AS 29.48.037 (b). For the watershed within the City limits, amendments to the City zoning ordinance is the most effective way to preserve the watershed. Adoption of a special watershed management ordinance will preserve the watershed outside of the City limits.

A more positive control measure would be for the City of Cordova to annex the land outside its municipal boundaries and implement the planning and zoning powers granted by the State to Cities of the Home Rule Class. This direction is recommended. Cordova is a First Class City and has adopted a home rule charter. It has all legislative powers not prohibited by law or charter. It must provide planning, platting, zoning, taxation, and education; and it can add other powers for the services of police, water, sewer, etc., by council action.

The 1976 Cordova Comprehensive Development Plan recommended a major increase to Cordova's corporate boundaries. At a minimum, the Plan suggested the City of Cordova should consider increasing its boundaries to extend as far northwest as Gravina Point, as far west as Hinchinbrook Island, as far east as Cape Suckling, and as far inland as the Chugach National Forest boundary.

This plan recommends an annexation process to be initiated upon adoption by the Coastal Policy Council. As a minimum land area, annexation should include all land within the Eyak Lake AMSA. Although outside the AMSA boundary, the entire drainage basin of Eyak Lake and the other watersheds that feed the communities water withdrawal points should be included. If, for some reason or other, the annexation process has negative results, the above mentioned option for extra-territorial jurisdiction should be implemented for the watershed.

The Eyak Lake AMSA Management Plan relies heavily on state and

federal statutes and regulations as authorities behind its policies and rules. These are compiled in the Alaska Land and Water Use Guide published by the State of Alaska, Office of Coastal Management.

Re-occurring hazards that jeopardize human life and property exist in the AMSA. Known geophysical hazard areas and areas of high development potential in which there is a substantial possibility that geophysical hazards may occur are: 1) flooding all around the lake, in the wetlands east of the weir, and in the Power Creek Delta area; 2) avalanche in the Mile 5, CRH area. Development in areas identified above may not be approved by the appropriate state authority or by the City of Cordova until siting, design and construction measures for minimizing property damage and protecting against loss of life have been approved.

The Alaska Department of Military Affairs should encourage appropriate federal and state agencies to improve information on types and locations of hazard areas in the AMSA. This agency should also instigate a study to determine the feasibility of a second outlet from the lake to reduce flood flows. The study should consider such solutions as a ditch along the CRH or a culvert whose function is to "kick in" when the lake level reaches some pre-determined height above the weir elevation. Lyon Associates (1970), reported, "During past floods, the water found its way out of the Lake by an old channel through Cordova. This has been further blocked since then by the highway fill. The culverts installed under the highway at this point do not look adequate to handle the excess."

In July of 1983, the Scott River began exiting largely from the west side of the Scott Glacier terminus rather than the east side as it had previously done. Now, the majority of Scott River water is flowing down the Ibeck Creek channel and spilling over into Eyak River about 1.5 miles downstream from Eyak Lake. According to a USFS hydrologist (USFS, 1983), the spillover means that Eyak River will have more water in it than in the past and will be less capable of draining the lake at flood stage. This means that the lake level will likely rise higher than in the past for the same flood conditions and could endanger buildings around the lake and along Eyak River.

Overwhelmingly apparent from the survey results (see Appendix A) is the importance of the Eyak Lake area in terms of scenic and recreation values. Non-consumptive uses are extremely high on the list by the percent age of people taking part in these activities. The scenic beauty and environmental quality of the area are the reasons these activities rate so high.

All indications point to increased development around the lake so it is important to make provisions for future recreation use and to maintain the overall scenic quality.

The Christian Center Beach (previously a Forest Service Picnic

Ground near Mile 5, CRH) was primarily a group use facility, but has been transferred to the Eyak Corporation under ANCSA and has been subdivided for development. To provide for group use now and in the long term, it is recommended that DNR issue a long-term public recreation lease on Mavis Island and the causeway with the addition of a boat launching ramp near the southeast corner of the causeway. This site is currently under lease to the Cordova Post, American Legion Club so this recommendation concerns the lease clauses which define public recreation as the long-term use and requires that of any lessee, current or future.

The City of Cordova should continue to redevelop and maintain Nirvana Park and Spit to serve the community's recreation needs. In its preparation of a Capital Improvements Plan, the City should include construction of a boat launching ramp on the Spit.

Highway and road turnouts serve a variety of purposes with scenic and wildlife viewing as primary attractions. DOT&PF should permanently dedicate the four paved turnouts along the CRH as public scenic viewpoints and maintain them as such. In addition, that agency should dedicate similar places along the Cordova Highway (Power Creek Road) in the long range highway maintenance/reconstruction plans. The process recommended to identify appropriate turnouts along this road is a committee composed of a representative from each of the following organizations: Cordova City Council, Cordova Land Coalition, Copper River/Prince William Sound Fish and Game Advisory Committee, and the local Maintenance Supervisor of DOT&PF. The local Maintenance Supervisor should convene this committee immediately upon adoption of this plan, develop the turnout nominations, hold a public hearing, and introduce final nominations into the highway planning process. These turnouts should be permanently dedicated to prevent other uses from conflicting. Nominations recommended in this plan are: 1) the mouth of Hatchery Creek, 2) the salmon spawning hole where the road crosses Hatchery Creek, 3) the stream gauging station on Power Creek, 4) a site adjacent to the spring hole in the lake approximately 1/2 mile southwest of the mouth of Hatchery Creek, 5) the site at the "Elk's Watering Hole", 6) and one at the boat landing beach approximately 1/2 mile beyond the Davis residence. Several of these nominated turnouts could accommodate a modest picnic facility.

Picnic sites will become more important as shoreline development proceeds. For this reason it is recommended that DNR reserve and dedicate the following sites for this use (all these sites are currently State land): the boat landing beach on the north shore; the timbered hill on the lake side of the CRH adjacent to the turnout just west of Mavis Island. The weir access road has been used in the past for picnicking, but the activities connected with it, namely shooting, have posed a danger to residents at Mile 5. Shooting also disturbs the resting waterfowl so it is recommended that DOT&PF barricade the road to prevent vehicle access subject to approval of the landowner on whose land the road exists.

Three boat launching ramps are available on the lake. The wooden, city-owned ramp at Chitina Air Service lease would likely cause difficulty with the critical air taxi operations so this ramp should be officially listed as "off limits" to boats by the City of Cordova. The concrete ramp at the east end of the city airstrip lacks only a small amount of adequate and safe parking space nearby but out of the way of aircraft operations to serve most users. DOT&PF should include this need in their airport master planning effort. The boat landing beach on the north shore currently serves as an unimproved boat launching site and this use should be planned into the DNR picnic site previously mentioned.

Two new boat launching ramps are recommended. The first priority is a ramp located at the southeast corner of Mavis Island causeway which should be included in the site plan for the Mavis Island American Legion lease. This site has the built in feature of adequate parking. The second priority is a ramp at Nirvana Park spit. This facility is recommended for the City of Cordova to include in its capital improvement plan for the park.

Crater Lake Trail, now on State land, is the most popular and heavily used trail in the Cordova area. The State should improve the trail and perform regular maintenance or enter into agreements with the U.S.F.S. and/or the City to accomplish this task. Such agreements may be the best solution as DNR has no permanent physical presence in Cordova. Power Creek Trail is in ANCSA over selection status but remains a public easement managed by the Forest Service. This trail also needs improvement. The Forest Service has placed this project in their program of work for the next five years for maintenance and improvement.

Navigability of the weir by small boats is a desire that has been expressed by many people at the several public hearings held during this study. This plan recommends under the fisheries section, conversion of the weir to facilitate a fish counting structure. Economically, more is at stake with the fishery resource than with navigability of the weir so the priority use goes to the fish. If possible and feasible, it is recommended that navigability be designed and built into the counting structure that is recommended elsewhere in the plan. The Forest Service boat landing on Eyak River will afford sufficient convenience to users that need access to the river.

This plan recommends that ORV use be restricted to the developed roadways in the vicinity of Power Creek Delta and the wetlands from the weir east to the AMSA boundary in order to minimize disturbance to bird life.

Aircraft float plane docking and operations shall be restricted from the open water near the weir and southeast arm during the winter months. This will prevent aircraft from disturbing the eagles, swans and loons.

Overlapping into the AMSA is an area of 4,420 acres that was

proposed by ADNR-Division of Parks as a special area in the Alaska Coastal Zone (OCM,1980). This area rises from the shore of Orca Inlet up the slopes of Mt. Eccles and includes the drainages of Nicolet, Heney, and Eccles Creeks and the city reservoir area, and swings around the mountain to approximately Murchison Falls Creek on the Eyak Lake side. Included in the DNR proposal were proposed management objectives: to preserve the natural beauty of the coast as seen from Cordova homes and roads, and to provide recreation opportunities for Cordova residents, as well as protecting the watershed. These objectives are still valid today. Opportunities for preparing the Mt. Eccles AMSA plan should be explored by the City of Cordova upon completion of the Eyak Lake AMSA.

The scenic quality found within the AMSA is highly acclaimed and revered. Changes in this visual resource are directly related to the degree of vegetative manipulation through activities such as timber harvest, subdivision development, etc. Since the visual quality objective for the area has been designated as "retention" (of the visual character), all applicable land management agencies and corporations, and land developers shall be guided by the following management direction: management activities, i.e., road construction, powerlines, etc. should not be visually evident; any visual impacts created should be mitigated immediately, and activities should be designed with an emphasis to minimize visual impacts. Additionally, timber harvest activities require mitigation plans, both because of the sensitivity of the area and because all such activity would be highly visible.

CHAPTER EIGHT: ISSUES AND CONFLICTS

The following list indicates the present and anticipated conflicts among uses and activities within or adjacent to the study area and was developed with the help of public hearing input during the course of the study. Throughout the course of the field work connected with this study, the majority of these issues and conflicts became obvious. They are grouped below according to the five major categories of this management plan.

WATER QUALITY

- A-1 Oil pollution from spills and surface runoff (incipient pollution)
- A-2 Raw sewage pollution from direct outfalls and inoperative septic systems
- A-3 Suspected power plant oil spill problem
- A-4 Road oiling vs. water quality
- A-5 Airplane fuel draining and spills vs. water quality
- A-6 Land clearing vs. erosion (siltation)

FISHERY PRODUCTION

- B-1 Loss of fish spawning habitat from:
 - Home building fill
 - Road fills
 - Airport fill
- B-2 Harassment of spawning fish by direct people disturbance
- B-3 Removal of shoreline gravel by local landowners and DOT/PP
- B-4 Pushing landslide material into lake from along Power Creek Road
- B-5 Development vs. spawning beaches:
 - Harassment to spawning fish
 - Degradation of spawning environment
 - Disruption of ground aquifer
- B-6 Possible increase BOD from domestic sewage oxidation that lowers the lake overwinter carrying capacity
- B-7 Potential future extreme seismic activity that is predicted for the area will, in all likelihood, alter the lake level.

WILDLIFE HABITAT

- C-1 Harassment of swans by hunters, recreational shooting, and ORV's
- C-2 Resting gulls interferring with aircraft operations
- C-3 Airplanes vs. birds, fish, peace of mind (noise pollution)
- C-4 Illegal (indiscriminant) firewood cutting vs. habitat vs. visual quality
- C-5 Spreading float plane parking enlarges the conflict area.
- C-6 Development in wetlands reduces habitat and alters water movement.

FUTURE DEVELOPMENT

- D-1 Gravel extraction from Mile 5 slide area upsetting the underground hydrologic system and triggering mass wasting
- D-2 Urban development inevitably encroaches on wildlife habitat
- D-3 Sedimentation from land development activities
- D-4 Development in stream corridors disrupts surface drainage
- D-5 Proposed development of a road around the backside of the lake could adversely impact some resources
- D-6 Mining vs. habitat, scenery, siltation, etc.
- D-7 Development in geological hazard areas causes life and Property hazard;
 - Avalanche paths
 - Floodplains
- D-8 Construction not complying w/earthquake and flood protection measures causes property damage and threat to life safety
- D-9 Bering coal development (access and transmission line) is a potential significant development
- D-10 Copper River Highway link to the Interior is just a matter of time.

RECREATION AND SCENIC VALUES

- E-1 Logging or land clearing vs. visual quality and habitat damage
- E-2 Power boaters vs. viewers, birds, and peace of mind
- E-3 Urban development vs. visual resource vs. access to shoreline
- E-4 Shooting vs. public health and safety
- E-5 ORV's disturbing wildlife and residents
- E-6 Navigability of weir is poor reducing trafficability to and from Eyak River
- E-7 Conflicting developments may occur adjacent to scenic highway turnouts so as to reduce their acceptability and usefulness.

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APPENDIX C: ABBREVIATIONS

ADC&RA	Alaska Dept. of Community & Regional Affairs
ADEC	Alaska Dept. of Environmental Conservation
ADF&G	Alaska Dept. of Fish and Game
ADMA	Alaska Dept. of Military Affairs
ADNR	Alaska Dept. of Natural Resources
ADOT/PF	Alaska Dept. of Transportation & Public Facilities
AMSA	Areas Meriting Special Attention
CRH	Copper River Highway
OCM	Alaska Office of Coastal Management
USDC	United States Dept. of Commerce
USDHUD	United States Dept. of Housing & Urban Development
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USF&WS	United States Fish and Wildlife Service
USGS	United States Geological Survey
Weir	ADF&G Weir at Eyak Lake outlet - Mile 5-1/2 CRH

APPENDIX D: WATER SAMPLING DATA

TABLE 1. EYAK LAKE BOD's (mg/L). \bar{X} = MEAN CONCENTRATION,

s = STANDARD DEVIATION, n = NUMBER OF OBSERVATIONS

(1981-82)

Station	12/16	2/22	3/25	4/16	\bar{X}	s	n
1A		2.1	1.4	1.1	1.53	0.51	3
1	0.55	3.4	0.3	1.3	1.39	1.41	4
1B		1.4	0.9	1.3	1.20	0.26	3
2	3.9	1.0	1.4	0.6	1.73	1.49	4
3	1.63	1.3	1.2	1.2	1.33	0.20	4
4A		3.5	1.0	0.7	1.73	1.54	3
4	2.95	1.5	1.3	0.5	1.56	1.02	4
4B		0.10	1.6	1.0	0.90	0.75	3
5	1.95	4.7	0.4	0.9	1.99	1.92	4
6A							
6	1.75			0.9	1.33	0.60	2
6B		0.4					
7A		2.1					
7	1.6	3.2	0.4	0.6	1.45	1.28	4
7B		1.3					
8A		1.2	0.6		0.90	0.42	2
8	1.75		1.0	0.5	1.08	0.63	3
8B			1.1				
9	1.15	1.5	1.0	0.8	1.11	0.30	4
10	1.65	1.9		0.7	1.22	0.48	3
11	0.30	3.7	0.6	0.5	1.28	1.62	4
12	1.15	2.5	0.2	1.0	1.21	0.95	4
13	0.7	3.8	0.2	0.9	1.40	1.63	4
14	1.55		0.6	0.8	0.98	0.50	3
15			0.7	0.6	0.65	0.07	2
16A			0.3				
16	6.3		0.7	0.7	2.57	3.23	3
16B			0.7				
17A							
17	0.6		0.1	0.5	0.40	0.26	3
17B							
18	0.45		0.4	0.7	0.52	0.16	3
19A			0.6				
19	0.75		0.3	0.8	0.62	0.28	3
20	0.85	5.3	0.1	0.9	1.78	2.37	4

BLE 2. HYAK LAKE, DISSOLVED OXYGEN (mg/L), TEMPERATURES (°C)

DEPTH (FT.)

(12/15-16/81, 4/14/82)

Station	D.O. Top	D.O. Bottom	°C Bot.	°C Top	Depth
			SAT	SAT	
1A	12.4	11.1	3.0	13.5	
1	12.1	11.2	3.0	13.5	3
1B	11.5	11.3	3.0	13.5	
2	8.8	10.3	0.0	14.6	4
3	13	12.5	3.0	13.5	6
4A	12.2	11.8	3.0	13.5	
4	6.0	11.0	3.0	13.5	7
4B	5.0	12.1	4.0	13.1	
5	5.0	10.0	3.0	13.5	
6)dry					2
7)dry					1
8	7.2	10.1	3.0	13.5	7
9A	9.3	10.2	4.0	13.1	
9	7.9	10.2	4.0	13.1	7
9B	8.8	11.0	4.0	13.1	
10	9.0	9.6	3.0	13.5	7
11	9.0	10.8	4.0	13.1	7
12	10.6	9.8	5.0	12.8	8
13	9.8	10.4	4.0	13.1	1
14A	12.3	12.2	5.0	12.8	
14	10.6	10.0	4.0	13.1	6
14B	14.0	11.4	4.0	13.1	
15	11.8	11.2	3.0	13.5	6
16	11.8	8.8	3.0	13.5	3
17	12.0	12.4	1.0	14.2	4
18	12.8	10.6	4.0	13.1	1
19	12.0	11.0	3.0	13.5	1
20	11.9	12.0	1.0	14.2	2

$$\bar{X} = 10.34$$

$$s = 2.57$$

$$n = 26$$

$$\bar{X} = 10.89$$

$$s = 0.93$$

$$n = 26$$

$$\bar{X} = 3.23$$

$$s = 1.14$$

$$n = 26$$

$$\bar{X} = 0.77$$

$$s = 0.65$$

$$n = 26$$

TABLE 3. PRIORITY POLLUTANTS (mg/L), TURBIDITY (NTU)'s)

STATIONS											
UNITS mg/L	STATIONS SAMPLED 12/15 - 16/81										LOWER LIMIT OF QUANTIFICATION
	2	4	6	8	10	12	14	16	18	20	
As	ND	ND	ND	TR	ND	ND	ND	0.005	ND	ND	0.005
Ba	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	0.200
Cd	0.002	0.001	TR	TR	TR	ND	TR	0.003	ND	ND	0.001
Cr	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Fe	0.12	TR	0.27	0.14	0.14	TR	TR	0.026	0.110	1.100	0.100
Pb	ND	ND	ND	ND	ND	ND	ND	0.006	ND	ND	0.005
Mn	0.017	TR	0.064	0.024	0.010	ND	ND	0.016	TR	0.043	0.005
Hg	ND	ND	ND	ND	ND	ND	ND	ND	TR	ND	0.001
Se	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003
Ag	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003
Na	TR	TR	TR	TR	TR	ND	ND	TR	TR	TR	0.030
NO ₃	ND	ND	TR	ND	TR	ND	ND	ND	TR	ND	1.000
O-PO ₄	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.500
TURB	0.34	0.57	0.50	0.67	0.85	0.20	0.32	0.57	0.35	1.5	
TWPR	9.1	8.7	4.0	5.0	4.6	5.6	7.1	9.4	2.0	7.5	
TDM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	

TABLE 3. (Con't) PRIORITY POLLUTANTS (mg/L), TURBIDITY (NTU's)

STATIONS											
UNITS mg/L	STATIONS SAMPLED 4/14/82										LOWER LIMIT OF QUANTIFICATION
	2	4	6	8	10	12	14	16	18	20	
As	ND	ND	DRY	ND	ND	ND	ND	ND	ND	ND	0.005
Ba	ND	ND	DRY	ND	ND	ND	ND	ND	ND	ND	0.200
Cd	ND	ND	DRY	ND	ND	ND	ND	ND	ND	ND	0.001
Cr	ND	ND	DRY	ND	ND	ND	ND	ND	ND	ND	0.005
Fe	0.34	0.22	DRY	0.46	0.12	ND	0.13	0.11	ND	0.31	0.100
Pb	ND	ND	DRY	ND	ND	ND	ND	ND	ND	ND	0.005
Mn	0.071	0.015	DRY	0.050	0.250	0.029	0.008	0.032	0.022	0.041	0.005
Hg	ND	ND	DRY	ND	ND	ND	ND	ND	ND	ND	0.001
Se	ND	ND	DRY	ND	ND	ND	ND	ND	ND	ND	0.003
Ag	ND	ND	DRY	ND	ND	ND	ND	ND	ND	ND	0.003
Na	ND	ND	DRY	ND	ND	ND	ND	ND	ND	ND	0.030
NO ₃	<0.05	<0.05	DRY	<0.05	<0.05	0.06	0.07	<0.05	0.05	0.01	0.050
O-PO ₄	<0.05	<0.05	DRY	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.500
TURB	1.7	1.4	DRY	3.9	0.7	0.6	0.4	0.6	0.6	3.2	
TWPR	6.0	8.0	DRY	8.0	7.0	7.0	8.0	8.0	10.0	13.0	

TABLE 4. E.P.A. MAXIMUM PRIORITY POLLUTANT CONCENTRATIONS (UNITS Mg/L)

ELEMENT	DRINKING WATER	AQUATIC LIFE
Arsenic (As)	0.050	_____
Barium (Ba)	1.000	_____
Cadmium (Cd)	0.010	(Soft water) 0.00004 (Salmonids & Cladocerans)
Chromium (Cr)	0.050	0.100
Iron (Fe)	0.300	1.000
Lead (Pb)	0.050	0.01 times 96 hr L.C. 50
Mercury (Hg)	0.002	0.050
Manganese (Mn)	0.050	_____
Selenium (Se)	0.010	0.01 times 96 hr L.C. 50
Silver (Ag)	0.050	0.01 times 96 hr L.C. 50
Nitrate (No ₃)	10.000	_____

BLE 5. FECAL COLIFORM ANALYSIS.

(12/15-16/8). 4/14/82)

STATION	RESULT	STATION	RESULT
1 A	NEGATIVE	9 B	POSITIVE
1	NEGATIVE	10	NEGATIVE
1 B	POSITIVE	11	NEGATIVE
2	NEGATIVE	12	NEGATIVE
3	NEGATIVE	13	NEGATIVE
4 A	NEGATIVE	14 A	NEGATIVE
4	NEGATIVE	14	NEGATIVE
4 B	NEGATIVE	14 B	NEGATIVE
5	POSITIVE	16	NEGATIVE
6	POSITIVE	17	NEGATIVE
7	NEGATIVE	18	NEGATIVE
8	POSITIVE	12	NEGATIVE
9	NEGATIVE	20	NEGATIVE

TABLE 6. EYAK LAKE SAMPLING RESULTS
BOD's, D.O. (mg/l)
4-13-82

Station #	Temp. C Bottom	Temp. C Top	D.O. Bottom	D.O. Top	BOD ₅
1A	2	3	12.4	11.1	11.1
1	3	0	12.1	11.2	1.3
1B	1	0	Sat.	11.3	1.3
2	0	0	8.8	10.3	0.6
3	3	1	13.0	12.5	1.2
4A	3	1	12.2	11.8	0.7
4	3	1	6.0	11.3	0.5
4B	4	1	5.0	12.1	1.0
5	3	1	5.0	10.0	0.9
6	-	-	day	-	0.8
7	-	-	day	-	0.6
8	3	1	7.2	10.3	0.5
9A	4	1	9.3	10.2	-
9	4	1	7.9	10.0	0.8
9B	4	0	8.8	11.0	0.9
10	3	1	9.0	9.8	0.7
11	4	1	9.0	10.8	0.5
12	5	2	10.8	9.8	1.0
13	4	2	9.8	10.4	0.9
14A	5	1	12.3	12.2	0.3
14	4	0	10.6	10.6	0.8
14B	4	0	14	11.4	0.4
15	3	0	11.8	11.2	0.6
16	3	1	11.8	8.8	0.8
17	1	1	12.8	12.4	0.5
18	4	0	12.8	10.6	0.7
19	3	0	12	11.0	0.8
20	1	1	12	12.0	0.9
Rockslide	2	4	0.2	11.2	

TABLE 7. EYAK LAKE SAMPLES
DISSOLVED OXYGEN
8-18-82

Station #	Temp. (C) Bottom	Temp. (C) Top	DO (mg/l) Bottom	DO (mg/l) 1' Depth
1.	10	12	13.8	13.0
2.	11	12.1	13.1	12.6
3.	15	15	10.5	10.3
4.	15	15.5	10.2	10.3
5.	16	16	10.5	10.4
6.	15	16	10	10.4
7.	16	16	9.4	9.8
8.	15.5	16	9.8	9.6
9.	16	16.2	10.1	9.9
10.	16	16	10	10.2
11.	15.5	15	10.7	10.6
12.	16	16	10.2	10.7
13.	15.6	16	9.8	9.8
14.	16	16	10.8	12.0
15.	16.5	16.5	10.3	10.4
16.	14	15	11	11.2
17.	14	14.5	10.2	10.6
18.	13	15	11.1	11.8
19.	14.5	15	11.2	11.5
20.	15	15	11.2	11.3

TABLE 7. (Con't)

EYAK LAKE SAMPLES
DISSOLVED OXYGEN
8-8-82

Station #	Temp. (C) Bottom	Temp. (C) Top	DO (mg/l) Bottom	DO (mg/l) 1' Depth
1.	7	6.5	11.8	11.3
2.	7	7	11.3	11.2
3.	11	11	10.8	10.8
4.	11	10	10.8	11.0
5.	11	11	11.2	11.0
6.	11	10	10.8	10.8
7.	11	11	10.5	10.5
8.	11	11	10.5	10.5
9.	11	11	10.8	10.7
10.	11	11	10.8	10.8
11.	11	11	10.8	10.3
12.	11	11	11	10.8
13.	10.5	10	9.8	9.6
14.	10.5	10.5	10.6	10.6
15.	11	11	10.4	10.4
16.	10.5	10	10.8	10.9
17.	10	9.5	11.0	9.6
18.	10	8.5	11	10.8
19.	10	10	11.2	11.0
20.	10	10	11.2	11.2

TABLE 8. EYAK LAKE SAMPLES
HEAVY METALS
9-8-82

Station #	Lead	Cadmium	Manganese
1.	<5	<2	44
2.	"	"	105
3.	"	"	<10
4.	59	<2	<10
5.	<5	<2	10
6.	<5	<2	38
7.	"	"	70
8.	"	"	87
9.	"	"	13
10.	"	"	<10
11.	"	"	"
12.	"	"	"
13.	"	"	"
14.	"	"	"
15.	"	"	"
16.	"	"	21
17.	"	"	22
18.	"	"	22
19.	"	"	21
20.	"	"	23

units micrograms./liter

TABLE 9. EYAK LAKE SAMPLES
FECAL COLI TEST RESULTS

Station#	4-17-82	7-1-82	7-27-82	8-19-82	9-8-82	10-10-82	11-12-82
1A	+						
1	-	+	-	-	+(6)	38	
1B	+						
2	-	+	+(2)	(2)	+(7)	1	2
3	-	+	-	-	+(2)	51	1
4A	-						
4	-	+	-	-	+(6)	8	1
4B	-						
5	+	+	-	-	+(31)	53	3
6	+	+	-	-	+(58)	27	3
7	+	+	-	-	+(58)	37	3
8	+	+	-	-	+(43)	245	4
9	-	+	-	(2)	+(25)	84	3
9B	+						
10	-	+	+(244)	-	+(29)	14	0
11	+	+	-	-	+(16)	10	3
12	+	-	-	-	+(28)	5	0
13	+	-	-	-	+(11)	4	0
14A	+						
14	+	+	+(6)	-	+(5)	0	0
14B	+						
15	+	+	-	-	+(2)	3	0
16	+	+	+(1)	-	-	0	0
17	+	+	-	-	-	1	0
18	+	+	-	-	+(1)	33	0
19	+	+	-	-	+(18)	13	0
20	+	+	-	-	+(8)	4	0

+ indicates positive coliform presence

- indicates negative coliform presence

numbers represent coliform count per 100 ml sample

Area Precipitation (sample date + two days previous)

.03 .82 .12 .02 1.9 2.7

TABLE 10. PRECIPITATION DATA
CORDOVA FAA

DAY	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
1	0	T	0	.18****	0	.01	.44	1.54
2	0	0	0	0	0	.20	.06	.29
3	0	0	0	0	.02	.05	.47	.82
4	0	0	0	.65	0	.02	.01	.92
5	0	0	0	.24	0	1.85	T	0
6	0	.03	0	0	.03	1.89	.46	0
7	0	0	T	.07	.31	.01	.66	0
8	.13	.12	.02	.05	1.36	0****	.60	.54
9	.02	.56	T	.01	.10	.06	1.74	0
10	.05	.44	.08	.37	.01	.06	.32****	0
11	0	.37	.71	T	.12		0	0
12	0	.0	.32	.20	0		.03	0****
13	0	.18	.11	0	T		2.01	.60
14	.32	.57	.29	.01	.10		1.57	0
15	0	.30	.23	.17	.15		2.31	0
16	.03	0	.28	.64	T		0	
17	T****	.21	.77	.07	.01		.64	
18	T	.31	.07	.01	.01		2.21	
19	.22	.05	.13	.01	0****		2.87	
20	.82	.12	.97	0	0		.19	
21	.58	.02	.21	.23	0		.89	
22	.01	0	.02	.17	.03		.46	
23	0	-	0	1.35	.28		0	
24	.02	.09	0	.19	.12		0	
25	.22	0	.32	.12	.08		0	
26	.99	T	0	T	0		.63	
27	.33	T	0	0****	1.22		.02	
28	.50	.15	.01	T	.96		.23	
29	.18	0	.62	1.55	1.04		.45	
30	.10	0	.02	.60	.85		.55	
31	T	0	-	.01	-			

***denotes sample collection date

APPENDIX E: AQUATIC PLANT SPECIES LIST

<u>Species</u>	<u>Common Name</u>
<i>Callitriche</i> sp. (hermaphroditica L.)	Water Starwort
<i>Carex kelloggii</i> W. Boott	Sedge
<i>Carex saxatilis</i> L. subsp. <i>laxa</i> (Trautv.) Kalela	Sedge
<i>Carex sitchensis</i> Prescott	Sedge
<i>Chara</i> Sp.	Stoneplant
<i>Elodea canadensis</i> Richard in Michx.	Frog's-Bit
<i>Fontinalis antisyretica</i> Hedw.	Water Moss
Gramineae sp.	Grass
<i>Isoetes muricata</i> Dur.	Quillwort
<i>Juncus articus</i> Willd.	Rush
<i>Myriophyllum spicatum</i> L.	Water Milfoil
<i>Nuphar polysepalum</i> Engelm.	Western Yellow Pond-Lily
<i>Potamogeton perfoliatus</i> L. subsp. <i>richardsonii</i> (Bennett) Hult.	Pondweed
<i>Ranunculus trichophyllus</i> Chaix.	Water Crowfoot
<i>Sparganium angustifolium</i> Michx.	Bur-reed